BUREAU AUTOMOTIVE REPAIR

Sunset Review Report 2013

Presented to the Senate Committee on Business, Professions, and Economic Development

DEPARTMENT OF CONSUMER AFFAIRS

BAR

Bureau of Automotive Repair

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Bureau of Automotive Repair (BAR)

BACKGROUND INFORMATION AND OVERVIEW OF THE CURRENT REGULATORY PROGRAM

November 1, 2013

Section 1 – Background and Description of the Bureau and Regulated Profession

The Bureau of Automotive Repair (BAR) was established within the California Department of Consumer Affairs (DCA) in 1972 with the enactment of the Automotive Repair Act (Act) (Senate Bill (SB) 51, Beilenson, Chapter 1578, Statutes of 1971), Business and Professions Code, Chapter 20.3, Section 9880, et seq. The Act mandated a statewide automotive repair consumer protection program, including the requirement that automotive repair dealers (ARDs)[1] be registered and regulated by BAR. The Act also gave BAR the authority to license and regulate official stations and mechanics in the areas of lamp, brake, and smog device inspection and repair. The Act protects consumers by requiring all ARD's, including lamp, brake, and Smog stations, to provide written estimates, to obtain written work authorization from their customers prior to commencing any repair services, and to provide customers with itemized invoices that detail the parts provided and the labor performed.

The Act requires BAR to mediate complaints, investigate violations, and take action against ARDs or Brake and Lamp stations and technicians that fail to comply with the Act or regulations adopted pursuant to the Act. BAR pursues these same consumer protections against licensed or unlicensed individuals.

In 1984, BAR also implemented a biennial Smog Check Program, also known as the motor vehicle inspection and maintenance program, pursuant to authority granted by SB 33 (Presley, Chapter 892, Statutes of 1982), which added Health and Safety Code, Chapter 5, Section 44000 et seq. SB 33 authorized BAR to implement, maintain, and enforce the Smog Check Program, which licenses Smog Check stations and technicians to reduce air pollution from vehicles through mandatory testing of vehicle emission control components. Smog Check stations must also be registered as ARDs to ensure that consumers receive protection associated with vehicle repairs. In addition, BAR ensures that the equipment used to perform Smog Check inspections and the inspections performed at Smog Check stations by Smog Check Inspectors or Technicians will achieve reductions in vehicle emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen. Recently, BAR's authority to protect consumers subject to the Smog Check Program was enhanced by Assembly Bill (AB) 2289, (Eng, Chapter 258, Statutes of 2010). Assembly Bill 2289 authorizes BAR to certify high performing Smog Check stations and technicians as *STAR* certified, which allows them to inspect and repair vehicles that are likely to be high polluters. Shortly after implementation, BAR was recognized for outstanding environmental achievements in government for the *STAR* Program and was named one of the *2013 Best of California Award* winners and received *The Green IT Award.* AB 2289 further increased the citation amounts for program violations by stations and technicians.

In addition to consumer protection functions, including licensing and enforcement, BAR administers the Consumer Assistance Program (CAP). CAP provides income eligible consumers whose vehicle fails a biennial Smog Check up to $500 in emissions-related repairs. CAP will also compensate consumers up to $1,500 for the voluntary retirement of an eligible vehicle that has failed its Smog Check. In 2010, CAP began administration of the Enhanced Fleet Modernization Program (EFMP), which was created by AB 118 (Núñez, Chapter 750, Statutes of 2007). EFMP offers eligible consumers up to $1,500 in compensation to voluntarily retire an eligible vehicle regardless of Smog Check history. In the South Coast and San Joaquin Valley air districts, EFMP also offers consumers who volunteer to retire their vehicle a voucher worth up to $2,500 toward the purchase of a newer, cleaner vehicle in a program administered by the Air Resources Board (ARB).

1 An automotive repair dealer is a person or entity who, for compensation, engages in the business of diagnosing or repairing malfunctions of motor vehicles.

BAR is headed by a Chief, who is appointed by the Governor and confirmed by the State Senate. The Chief serves at the pleasure of the Governor and under the direction and supervision of the Director of the Department of Consumer Affairs.

BAR actively seeks the advice of consumers, educators, the automotive and Smog Check industries, and other governmental agencies through the formation of two voluntary ad hoc advisory groups – the BAR Advisory Group (BAG) and the Educational Advisory Committee.

1. Describe the make-up and functions of each of the Bureau's committees (cf., Section 12, Attachment B).

The BAG was established to increase the level of communication between BAR, the automotive repair and Smog Check industries, and consumers. The BAG is comprised of an informal assembly of 12 members and meets periodically to provide input to the Chief on BAR's programs. BAG meetings are announced on BAR's Web site and are open to the public. The most recent BAG meeting was held on September 17, 2013. Names of the BAG members are provided in Table 1b.1 below.

In addition to BAG, BAR established an Educational Advisory Committee. The committee meets twice each year to discuss educational needs and make recommendations to BAR for a variety of classes needed for inspectors and technicians working within the Smog Check Program. The current committee is comprised of 16 members: five BAR staff, five educators, and six industry representatives (shop owners and/or technicians). Names of the Educational Advisory Committee members are provided in Table 1b.2 on page 3.

Table 1b.1. Bureau/Committee Member Roster (BAR Advisory Group)

Member Name (Include Vacancies)	Date First Appointed	Date Re-appointed	Date Term Expires	Appointing Authority	Type (public or professional)
Louis Anapolsky, Knox, Lemmon, Anapolsky & Schrimp LLP	1/12/04	N/A	N/A	BAR	Professional
Drew Carlson, California Automotive Teachers (CAT)	2/13/12	N/A	N/A	BAR	Professional
Paul Frech, President, Automotive Trade Organizations of California (AUTO-CA)	7/25/03	N/A	N/A	BAR	Professional
Johan Gallo, President, California Automotive Business Coalition	5/7/09	N/A	N/A	BAR	Professional
George Hritz, California Automotive Teachers (CAT)	10/20/03	N/A	N/A	BAR	Professional
Craig Johnson, Automotive Service Councils of California (ASCCA)	11/17/10	N/A	N/A	BAR	Professional
Jon McConnel, Independent Automotive Professionals Association (IAPA)	10/10/07	N/A	N/A	BAR	Professional
Jack Molodanof, Attorney, California Auto Body Association (CAA)	7/25/03	N/A	N/A	BAR	Professional
Susan Monser Ward, California Emissions Testing Industries Association (CETIA)	1/20/09	N/A	N/A	BAR	Professional
Rosemary Shahan, President, Consumers for Auto Reliability and Safety (CARS)	7/25/03	N/A	N/A	BAR	Public
Chris Walker, Automotive Repair Coalition - Nossaman, LLP	7/25/03	N/A	N/A	BAR	Professional
Jonathan Morrison, California New Car Dealers Association	9/17/13	N/A	N/A	BAR	Professional

Table 1b.2. Bureau/Committee Member Roster (Educational Advisory Committee)					
Member Name Include Vacancies)	Date First Appointed	Date Re-appointed	Date Term Expires	Appointing Authority	Type (public or professional)
Rocky Carlisle, BAR*	11/1/12	N/A	N/A	BAR	Professional
Ed VanMil, BAR*	11/1/12	N/A	N/A	BAR	Professional
Greg Garrett, BAR*	11/1/12	N/A	N/A	BAR	Professional
Vacant, BAR*	11/1/12	N/A	N/A	BAR	Professional
Dara Dubois, State Department of Education*	11/1/12	N/A	N/A	BAR	Professional
Jim Custeau, Educator	5/8/2012	N/A	5/31/2015	BAR	Professional
Phil Fournier, Educator	5/8/2012	N/A	5/20/2015	BAR	Professional
Mike Morse, Educator	5/8/2012	N/A	11/14/2014	BAR	Professional
Kevin Rogers, Educator	5/8/2012	N/A	8/31/2013	BAR	Professional
Steve Tomory, Educator	5/8/2012	N/A	5/31/2015	BAR	Professional
Bud Rice, Station Owner	5/8/2012	N/A	11/14/2014	BAR	Professional
Craig Johnson, Station Owner	5/8/2012	N/A	8/31/2014	BAR	Professional
Mike Palmer, Station Owner	5/8/2012	N/A	5/31/2013	BAR	Professional
Justin Bunch, Technician	5/8/2012	N/A	5/31/2013	BAR	Professional
Gary Houseman, Technician	5/8/2012	N/A	5/31/2013	BAR	Professional

* State employee

2. In the past four years, was the Bureau unable to hold any meetings due to lack of quorum? If so, please describe. Why? When? How did it impact operations?

A quorum is not necessary for the voluntary BAG or Education Advisory Committee since these groups do not decide or vote on any of BAR's business functions or policy decisions.

3. Describe any major changes to the Bureau since the last Sunset Review, including:

- **Internal changes (i.e., reorganization, relocation, change in leadership, strategic planning)**

  Since BAR's last Sunset Review in 2003, there have been five leadership (BAR Chief) changes. The current BAR Chief (Acting) is Patrick Dorais. Prior BAR Chiefs since the 2003 Sunset Review were John Wallauch (2012-2013), Sherry Mehl (2007-2012), Richard Ross (2004-2007), and Patrick Dorais (2003-2004).

  BAR's Strategic Plan identifies goals and objectives based on BAR's statutory mandates and responds to changes in the automotive repair and Smog Check industries. BAR's *Strategic Plan* is generally updated every four years and includes goals for educating and protecting consumers from illegal and unethical practices and achieving the emission reduction goals of the Smog Check Program. BAR's 2013 – 2017 Strategic Plan is Attachment A.

  Prior to 2008, the responsibilities of enforcement related functions such as complaint mediation, investigations, and formal and informal disciplinary actions were treated separately according to whether the issue concerned general consumer protection issues or the Smog Check Program. In an effort to ensure consistency in BAR's enforcement activities and functions, in 2008, the program division was eliminated, merging with Consumer Protection Operations and Smog Check Enforcement Operations, and creating a single enforcement program at BAR. This led to a major enforcement reorganization that necessitated the merging of office resources and staff functions.

  In July 2012, BAR's headquarters office was relocated from Sacramento to 10949 North Mather Boulevard, Rancho Cordova, CA 95670. The new location is approximately four miles from the prior location.

- **All legislation sponsored by the Bureau and affecting the Bureau since the last sunset review.**

  The Bureau does not sponsor legislation; however, since the 2003 Sunset Review, BAR's authority and mandates have been amended by numerous pieces of legislation. A listing of these bills can be found on the *Impacting Legislation 2003 – 2013* document (Attachment B).

- **All regulation changes approved by the Bureau since the last sunset review. Include the status of each regulatory change approved by the Bureau.**

  Also since 2003, BAR has adopted, amended, and repealed a significant amount of regulatory actions. A listing of these actions can be found on the *Regulatory Actions 2003 – 2012* document (Attachment C).

4. Describe any major studies conducted by the bureau (cf., Section 12, Attachment C)

a. Evaluation of the California Smog Check Program Using Random Roadside Data March 12, 2009, Sierra Research, Inc., for the Air Resources Board and the Bureau of Automotive Repair, 2010 Addendum, Air Resources Board and Bureau of Automotive Repair

ARB, in cooperation with BAR, commissioned Sierra Research, Inc. to conduct an independent research and analysis of the Smog Check Program using data collected from roadside inspections from 2003 to 2006. The study compared roadside inspection results for 1976 through 1995 (pre-On-board Diagnostics II) model-year vehicles to the Smog Check inspection results reported by Smog Check stations for these same vehicles.

b. Comparative Analysis of Current Training and Proposed Training Initiatives for Smog Check Technicians, February 6, 2009, COMIRA for the Bureau of Automotive Repair

COMIRA provided an in-depth analysis of BAR's Smog Check training processes and provided recommendations to better meet the needs of BAR's Licensing program and its licensees. The resulting report served as a foundation for adopting regulations to establish practical licensing and training practices.

c. Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California, February 2009, Donnoe & Associates, Inc. for the Bureau of Automotive Repair

The Donnoe and Associates analysis identified the specific knowledge, skills and abilities associated with both Smog Check inspections and Smog Check repairs. This analysis provided BAR with the details needed to implement improvements to the Smog Check licensing program, including updates to the license classes, training, and examinations.

The independent analysis by COMIRA and Donnoe & Associates was used to develop regulations to establish licensing requirements that reflect the best practices of the marketplace and better meet the business and professional needs of its licensees.

d. Evaluation of Remote Sensing for Improving California's Smog Check Program, March 3, 2008, Eastern Research Group, Inc. for the Air Resources Board and Bureau of Automotive Repair

ARB and BAR conducted a pilot study to evaluate whether use of on-road emissions measurement systems, commonly known as Remote Sensing Devices (RSD), could improve the effectiveness of the Smog Check Program. The study focused on the practicality and cost-effectiveness of an RSD Program to determine whether it could supplement California's existing Smog Check program, not one that would replace it.

The study found that in situations such as California's where a Smog Check program already exists, utilizing an RSD program is cost-prohibitive. The cost of using RSD to select individual vehicles for special action (such as identifying high emitters for immediate testing, clean-screening vehicles and identifying vehicles for subsequent scrap programs) within the Smog Check Program generally outweighs the estimated benefits. However, within the pilot program, RSD generated relevant, but limited, information on the effectiveness of the Smog Check Program and the characteristics of California's fleet.

e. *2006 Final Report Bureau of Automotive Repair Enforcement Monitor, December 15, 2006, STRATEGICA Inc., presented to the Department of Consumer Affairs and Joint Committee on Bureaus, Commissions and Consumer Protection*

The scope of this report was an independent audit and evaluation authorized by the passage of SB 1542 (Figueroa, Chapter 572, Statutes of 2004) and produced by STRATEGICA Inc., focusing on the Enforcement unit of BAR. The report also focused on how consistent, equitable, and fair BAR has been in regard to applying the applicable laws and regulations to all BAR's licensees statewide. This audit was undertaken to assure all stakeholders that BAR's Enforcement unit was operating within the authority and provisions granted by federal and California statutes and regulations. The results of this audit were published in the STRATEGICA Inc. report dated June 9, 2006, and are available on BAR's Web site.

f. *April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program, Report to the Legislature submitted by the Air Resources Board and the Department of Consumer Affairs, Bureau of Automotive Repair*

The report was required by statute. It assessed the effectiveness of the Smog Check Program and recommended several improvements, including an annual inspection of older vehicles and high usage vehicles, an inspection of smoking vehicles, and to establish more stringent cut-points.

5. List the status of all national associations to which the Bureau belongs.

- **Does the Bureau's membership include voting privileges?**
- **List committees, workshops, working groups, task forces, etc., on which Bureau participates.**
- **How many meetings did Bureau representative(s) attend? When and where?**
- **If the Bureau is using a national exam, how is the bureau involved in its development, scoring, analysis, and administration?**

BAR belongs to the Inspection and Maintenance (I/M) Solutions Training Forum, which began 17 years ago. This national association provides an annual forum where representatives of all the I/M states, Canada, and the United States Environmental Protection Agency (USEPA) convene to discuss the current status of I/M Programs such as Smog Check. The forum provides an opportunity for I/M states to talk with the USEPA and other invited attendees about I/M planning and implementation issues. BAR does not have voting privileges, but attends the annual forum when funding permits and out-of-state travel is approved. In 2012, BAR hosted the training forum in Sacramento. Recently BAR attended the 2013 annual forum held in Schaumburg, Illinois, May 4 - 8, 2013. BAR does not utilize a national exam.

Section 2 – Performance Measures and Customer Satisfaction Surveys

6. Provide each quarterly and annual performance measure report as published on the DCA website.

Quarterly and annual reports of *Performance Measures* (Attachment J) provide stakeholders with BAR's progress in meeting its enforcement goals and targets.

7. Provide results for each question in the customer satisfaction survey broken down by fiscal year. Discuss the results of the customer satisfaction surveys.

Beginning in 2010, BAR discontinued the use of postcards to gauge consumer satisfaction and began using a Web-based survey application. Each consumer filing a complaint with BAR is sent a closure letter upon completion of the complaint mediation. The letter briefly outlines the results of the complaint and refers the consumer to a Web site and requests that the consumer complete a brief survey. Overall, the responses are positive, as indicated in the table on the next page.

Automotive Repair Program Complaints_Consumer Satifaction Survey Results			
	2010/11	**2011/12**	**2012/13 ***
Number of Surveys Mailed (Estimate):	18,047	18,105	17,548
Number of Survey Responses:	592	633	574
QUESTIONS *Responses to Questions 1-9 represent the total of somewhat satisfied and extremely satisfied for each question.*	**Percent Satisfied by Fiscal Year**		
1. Was our representative courteous?	96%	95%	92%
2. Do you feel that the representative who handled your complaint understood your problem?	93%	93%	88%
3. Were you made aware that your complaint was closed?	91%	92%	87%
4. Did our representative deal with your problem in a fair and reasonable manner?	88%	89%	83%
5. How satisfied were you with the time it took for us to resolve your complaint?	76%	78%	67%
6. How satisfied were you with the explanation you were provided regarding the outcome of your complaint?	75%	78%	69%
7. Overall, how satisfied were you with the way in which we handled your complaint?	78%	81%	71%
8. Would you contact us again for a similar situation?	90%	93%	86%
9. Would you recommend us to a friend or family member experiencing a similar situation?	90%	89%	87%

Section 3 – Fiscal and Staff

BAR is funded by three special funds that provide revenue to maintain all of BAR's Programs. Each program is separately listed below. See Attachment K for a complete schedule of workload and revenue sources.

Current Revenue for BAR

- **Vehicle Inspection and Repair Fund (VIRF)**
  - SB 51, Beilenson, Chapter 1578, Statutes of 1971
  - Business and Professions Code Section 9886
- **High Polluter Repair or Removal Account (HPRRA)**
  - SB 198, Kopp, Chapter 28, Statutes of 1994
  - Health & Safety Code Section 44091
  - HPRRA is an account within the VIRF
- **Enhanced Fleet Modernization Subaccount (EFMS)**
  - AB 118, Núñez, Chapter 750, Statutes of 2007
  - Health & Safety Code Section 44126
  - EFMS is a sub account within the HPPRA

Account Number	Revenue Category	VIRF Revenue in thousands					Estimated Revenue
		FY 2008/09	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14*
125600	Brake & Lamp fees	$1,855	$2,097	$1,950	$1,483	$1,324	$1,521
125700	SMOG, Licensing & Abatement	$100,105	$100,945	$101,842	$108,749	$107,624	$111,028
125800	Renewal fees	$7,305	$7,456	$7,369	$7,424	$7,539	$7,480
125900	Fines & penalties	$228	$276	$254	$247	$250	$261
141200 00	Sale of documents	$3	$2	$3	$3	$3	$3
142500 90	Misc. service to public	$10	$12	$12	$7	$ -	$10
150300	Income from surplus money investment	$1,286	$281	$261	$287	$269	$252
150500	Interest Income from interfund loans	$57	$ -	$ 3	$ -	$ -	$ -
160400	Sale of fixed assets	$24	$112	$31	$1	$19	$38
161000	ESCHEAT/ Rev cancelled warrants	$7	$5	$10	$6	$4	$8
161400	Misc. revenue	$10	$3	$5	$776	$7	$162
303260	TR from Professional Fiducuary Fund	$ -	$ -	$215	$ -.	$ -	$ -
	Total	$110,890	$111,189	$111,955	$118,983	$117,039	$120,763

* FY 2013/14 is projected.

Account Number	Revenue Category	HPRRA Revenue in thousands					Estimated Revenue
		FY 2008/09	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14*
125600	Other regulatory fees	$ -	$ -	$273	$735	$456	$750
125700	Other regulatory licenses and permits	$41,436	$38,621	$35,199	$35,458	$34,089	$36,034
131700	Renewal and registration	$144	$115	$87	$63	$54	$89
150300	Income from surplus money investments	$805	$119	$37	$38	$40	$ -
150500	Interest income from interfund loans	$ -	$ -	$1,422	$ -	$ -	$ -
161000	ESCHEAT/Rev cancelled warrants	$ -	$ -	$ -	$4	$3	$ -
	Total	$42,385	$38,855	$37,018	$36,298	$34,642	$36,873

* FY 2013/14 is projected.

Account Number	Revenue Category	EFMP Revenue in thousands					Estimated Revenue
		FY 2008/09	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14*
114300	$1 Vehicle Registration	$29,015	$28,902	$28,338	$31,148	$30,126	$29,406
150300	Income from surplus money investments	$248	$269	$117	$ 68	$ 50	$ -
150500	Income from interfund loans	$ -	$ -	$ -	$ 87	$ -	$ -
	Total	$29,263	$29,171	$28,455	$31,303	$30,176	$29,406

* FY 2013/14 is projected.

8. Describe the bureau's current reserve level, spending, and if a statutory reserve level exists.

Each special fund is shown below in a table identifying reserve level and spending. BAR's funds currently have reserves, however, these reserves are not in amounts sufficient to require BAR to modify its fees pursuant to Business and Professions Code Section 128.5.

Vehicle Inspection and Repair Fund (VIRF)

Between Fiscal Year 2008/09 and Fiscal Year 2012/13, BAR derived approximately 91% of its annual revenue from an $8.25 Smog Check certification fee, and an annual $2.00 Smog Abatement Fee charged to vehicles six model years old or newer during years two through six of the Smog Check exception for which the Smog Abatement fee was levied. License and registration fees generate approximately 7% of the revenue generated in support of BAR. The VIRF also has funds deposited into it as a result of litigation pursued by BAR. The VIRF funds all of BAR's operations, except CAP, which is funded by HPRRA, and EFMP, which is funded by EFMS.

Fund Condition VIRF						
(Dollars in Thousands)	FY 2008/09	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14 [4]
Beginning Balance	$70,326	$41,934	$51,209	$62,414	$65,274	$72,363
Revenues and Transfers	$110,890	$111,189	$111,740	$118,983	$117,039	$80,763
Total Resources	$181,216	$153,123	$162,949	$181,397	$182,313	$153,126
Budget Authority	$105,318	$97,393	$89,428	$100,976	$94,317	$114,043
Expenditures [1]	$118,239	$110,020	$103,800	$116,123	$109,950	$130,040
Loans to General Fund [2]	$25,000	$0	$0	$0	$0	$0
Accrued Interest [3]	$1,286	$281	$261	$287	$269	$252
Loans Repaid From General Fund	$0	$0	$0	$0	$0	$0
Fund Balance	$38,817	$43,103	$59,364	$65,274	$72,363	$23,086
Months in Reserve	4.2	5.0	6.1	6.4	6.7	2.1

1 Expenditures are projected for FY 2013/14, and include direct appropriation draws to SCO, Fi$cal, and ARB.
2 Loans included in Revenues and Transfers.
3 Included in Revenue and Transfers.
4 FY 2013/14 is projected.

High Polluter Repair or Removal Account (HPRRA)

The HPRRA, within the VIRF, funds the activities of the CAP. CAP is designed to provide financial assistance to qualified consumers for the voluntary repair or retirement of a vehicle failing a Smog Check inspection. The revenue that funds this program also comes from the annual Smog Abatement Fee in the form of $6 in year one and $4 in years two through six, and to a much lesser extent, a portion of the revenue generated from the sale of vehicles impounded by local law enforcement agencies and temporary operating permits issued by DMV.

HPRRA generated $51 million in Fiscal Year 2007/08, and $35 million in 2012/13. This revenue reduction from abatement fees was directly related to the drop in new vehicle sales from 2 million in 2007 to 1 million in 2009. Since 2009, vehicle sales have recovered to an annual pace of 1.5 million in 2012 and are growing at an annual rate of approximately 3%. The revenue supports three appropriations that cover program administration ($9.3 million), vehicle retirement ($20.2 million), and repair assistance ($11.8 million).

Fund Condition HPRRA

(Dollars in Thousands)	FY 2008/09	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13	FY 2013/14 [2]
Beginning Balance	$52,237	$22,616	$4,808	$11,885	$10,945	$15,995
Revenues and Transfers	$22,385	$38,855	$57,018	$36,298	$34,642	$36,873
Total Resources	$74,622	$61,471	$61,826	$48,183	$45,587	$52,868
Budget Authority	$53,646	$55,456	$51,979	$40,468	$32,097	$41,329
Expenditures [1]	$53,674	$55,515	$52,154	$37,291	$29,592	$41,523
Loans to General Fund	$20,000	$0	$0	$0	$0	$0
Accrued Interest	$805	$119	$37	$38	$40	$0
Loans Repaid From General Fund	$0	$0	$20,000	$0	$0	$0
Fund Balance	$20,948	$5,956	$9,672	$10,945	$15,995	$11,345
Months in Reserve	4.5	1.4	2.9	3.3	4.6	3.3

1 Expenditures are projected for FY 2013/14, and include direct appropriation draws to SCO and Fi$cal

2 FY 2013/14 is projected.

Enhanced Fleet Modernization Subaccount (EFMS)

EFMS was created by AB 118 (Núñez, Chapter 750, Statutes of 2007) to fund the Enhanced Fleet Modernization Program (EFMP), which augments the State's existing statewide vehicle retirement program that is administered by CAP. Approximately $30 million is available annually through January 1, 2024 to fund the EFMS via a $1 annual increase in vehicle registration fees. In consultation with BAR, ARB developed regulations for administration of EFMP.

Fund Condition EFMS						
(Dollars in Thousands)	**FY 2008/09**	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**	**FY 2013/14 [2]**
Beginning Balance	$0	$29,262	$58,419	$5,514	$20,325	$15,856
Revenues and Transfers	$29,263	$29,171	-$31,545	$51,303	$30,176	$31,774
Total Resources	$29,263	$58,433	$26,874	$56,817	$50,501	$47,630
Budget Authority	$0	$0	$20,515	$37,879	$37,311	$44,393
Expenditures [1]	$0	$0	$20,515	$36,492	$34,645	$44,564
Loans to General Fund	$0		$60,000	$0	$0	$0
Accrued Interest	$0		$117	$68	$50	$0
Loans Repaid From General Fund	$0		$0	$20,000	$0	$0
Fund Balance	$29,263	$58,433	$6,359	$20,325	$15,856	$3,066
Months in Reserve	0.0	34.2	2.0	6.1	4.3	N/A [3]

1 Expenditures are projected for FY 2013/14, and include direct appropriation draws to SCO and Fi$cal.

2 Projected FY 2013/14 data. FY 2012/13 includes an $8 million appropriation pursuant to SB 359 (Corbett, Chapter 415, Statutes of 2013).

3 Program spending authority expires on June 30, 2014.

9. Part I. Describe if/when a deficit is projected to occur and if/when fee increase or reduction is anticipated.

BAR does not currently project any deficits.

Part II. Describe the fee changes (increases or decreases) anticipated by the Bureau.

BAR does not anticipate increasing or decreasing its fees in the near future.

10. Describe history of General Fund loans.

See the table below for a history of General Fund loans.

Fund	**Entity (BAR)**	**Loan Amounts [1]**						**Total Loans to General Fund**	**Repaid**		**Total Loan Balances Remain FY 2012/13 [2]**
		FY 2002/03	**FY 2003/04**	**FY 2008/09**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**		**FY 2010/11**	**FY 2011/12**	
0421	VIRF	$100,000	$14,000	$25,000				$139,000			$139,000
0582	HPRRA			$20,000				$20,000	$20,000		$0
3122	EFMS				$60,000			$60,000		$20,000	$40,000
	TOTAL	$100,000	$14,000	$45,000	$60,000			$219,000	$20,000	$20,000	$179,000

1 Loan amounts in thousands of dollars.

2 Excludes interest.

11. Describe the amounts and percentages of expenditures by program component. Use to provide a breakdown of the expenditures by the bureau in each program area. Expenditures by each component (except for pro rata) should be broken out by Personal Expenditures (PS) and Other Expenditures (Operational Equipment and Expenditures (OE&E)).

Table 3. Expenditures by Program Component

Expenditures by Program Component(1)

VIRF	FY 2008/09				FY 2009/10				FY 2010/11				FY 2011/12				FY 2012/13			
	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]
Administration[3]	$10,729,954	$46,688,837	$57,418,791	54.3%	$10,538,055	$42,402,967	$52,941,022	53.9%	$10,566,101	$33,600,476	$44,166,577	49.2%	$11,780,994	$42,283,817	$54,064,811	53.2%	$11,955,129	$34,958,073	$46,913,202	49.5%
Licensing	$1,555,628	$290,569	$1,846,197	1.8%	$1,578,760	$128,836	$1,707,596	1.7%	$1,576,900	$215,843	$1,792,743	2.0%	$1,630,934	$174,913	$1,805,847	1.8%	$1,883,834	$280,760	$2,164,594	2.3%
Enforcement:	$33,311,038	$13,110,998	$46,422,036	43.9%	$29,872,569	$13,747,202	$43,619,771	44.4%	$30,533,238	$13,268,789	$43,802,027	48.8%	$31,941,290	$13,818,267	$45,759,557	45.0%	$31,979,296	$13,725,577	$45,704,873	48.2%
TOTALS	$45,596,620	$60,090,404	$105,687,024	100%	$41,989,384	$56,279,005	$98,268,389	100%	$42,676,239	$47,085,108	$89,761,347	100%	$45,353,218	$56,276,997	$101,630,215	100%	$45,818,259	$48,964,410	$94,782,669	100%
DCA Pro Rata(4)		$17,852,846				$16,836,960				$15,897,271				$16,334,820				$15,389,953		

1 Collected reimbursements are not included in expenditures.
2 Percentage is of a categories total expenditure relative to the funds total expenditure.
3 Administration includes costs for executive staff, Bureau, administrative support, and fiscal services.
4 DCA Pro Rata included in the admin OE&E.

Expenditures by Program Component

HPRRA	FY 2008/09				FY 2009/10				FY 2010/11				FY 2011/12				FY 2012/13			
	Personnel Services	OE&E	Total	%[1]	Personnel Services	OE&E	Total	%[1]	Personnel Services	OE&E	Total	%[1]	Personnel Services	OE&E	Total	%[1]	Personnel Services	OE&E	Total	%[1]
Administration	$5,050,790	$6,585,003	$11,635,793	21.7%	$4,596,818	$7,357,939	$11,954,757	21.6%	$4,596,177	$5,339,128	$9,935,305	19%	$4,246,277	$5,465,977	$9,712,254	24.0%	$4,501,844	$4,260,767	$8,762,611	29.8%
Repair Assistance		$19,009,000	$19,009,000	35.4%		$24,415,931	$24,415,931	44.0%		$18,409,264	$18,409,264	45.5%		$10,511,759	$10,511,759	26.0%		$4,315,113	$4,315,113	14.7%
Vehicle Retirement		$23,000,350	$23,000,350	42.9%		$19,085,285	$19,085,285	34.4%		$23,634,943	$23,634,943	45.5%		$20,193,836	$20,193,836	50.0%		$16,306,138	$16,306,138	55.5%
TOTALS	$5,050,790	$48,594,353	$53,645,143	100%	$4,596,818	$50,859,155	$55,455,973	100%	$4,596,177	$47,383,335	$51,979,512	100%	$4,246,277	$36,171,572	$40,417,849	100%	$4,501,844	$24,882,018	$29,383,862	100%
DCA Pro Rata(2)		$1,956,952				$2,128,883				$2,104,106				$1,690,878				$1,548,250		

1 Percentage is of a categories total expenditure relative to the funds total expenditure.
2 DCA Pro Rata included in admin OE&E.

Expenditures by Program Component

EFMS	FY 2008/09				FY 2009/10				FY 2010/11				FY 2011/12				FY 2012/13			
	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]	Personnel Services	OE&E	Total	%[2]
Administration	$0	$0	$0	0%	$0	$0	$0	0%	$186,161	$355,509	$541,670	2.6%	$425,892	$2,711,446	$3,137,338	8.3%	$300,357	$1,487,220	$1,787,577	5.1%
Voucher Program										$0	$0	0.0%		$750,000	$750,000	2.0%		$237,500	$237,500	0.7%
Off Cycle Retirement										$19,973,189	$19,973,189	97.4%		$33,993,008	$33,993,008	89.7%		$32,735,855	$32,735,855	94.2%
TOTALS	$0	$0	$0	0%	$0	$0	$0	0%	$186,161	$20,328,698	$20,514,859	100%	$425,892	$37,454,454	$37,880,346	100%	$300,357	$34,460,575	$34,760,932	100%
DCA Pro Rata(3)		$0				$0				$0				$123,564				$22,933		

1 Program implemented in August 2010.
2 Percentage is of a categories total expenditure relative to the funds total expenditure.
3 DCA Pro Rata included in admin OE&E.

12. Describe license renewal cycles and history of fee changes in the last 10 years. Give the fee authority (Business and Professions Code and California Code of Regulations citation) for each fee charged by the bureau.

BAR has not had any fee changes for licenses, registrations, or renewals within the last 10 years. The license renewal cycles and fee authority for each fee charged are as follows:

Fee Authority and Renewal Cycle				
License Type	**Renewal Cycle**	**Business and Professions Code**	**Health and Safety Code**	**California Code of Regulations, Title 16**
Automotive Repair Dealer	Annually	9886.3		3351 & 3351.1
Smog Check Test & Repair Station	Annually	9882	44034	3340.10
Smog Check Test Only Station	Annually		44034	3340.10
Smog Check Repair Only Station	Annually		44034	3340.10
Brake Station	Annually	9887.2		3306
Lamp Station	Annually	9887.2		3306
Advanced Emission Specialist	Biennially		44031.5 & 44045.5	3340.29
Basic Area Technician	Biennially		44031.5 & 44045.5	3340.29
Smog Check Inspector	Biennially		44031.5 & 44045.5	3340.29
Smog Check Repair Technician	Biennially		44031.5 & 44045.5	3340.29
Brake Adjuster	Every four years	9887.2		3310
Lamp Adjuster	Every four years	9887.2		3310

Table 4. Licensing Fee Schedule and Revenue							
Fee	**Current Fee Amount ($)**	**Statutory Limit ($)**	**FY 2009/10 Revenue ($)**	**FY 2010/11 Revenue ($)**	**FY 2011/12 Revenue ($)**	**FY 2012/13 Revenue ($)**	**% of Total Revenue ($)**
Automotive Repair Dealer (Initial)	200	200	842,400	779,000	820,800	726,200	9.69
Automotive Repair Dealer (Renewal)	200	200	6,539,800	6,659,000	6,559,600	5,905,600	78.54
Smog Check Test & Repair Station (Initial)	100	100	41,600	37,300	39,900	55,200	.53
Smog Check Test & Repair Station (Renewal)	100	100	453,100	450,100	452,000	392,600	5.34
Smog Check Test Only Station (Initial)	100	100	48,400	49,100	49,400	43,600	.58
Smog Check Test Only Station (Renewal)	100	100	175,700	189,300	193,600	171,500	2.23
Smog Check Repair Only Station (Initial)	100	100	*	*	*	5,700	.02
Smog Check Repair Only Station (Renewal)	100	100	*	*	*	N/A	N/A
Brake & Lamp Station (Initial)	10	10	3,120	2,650	2,940	2,420	.03
Brake & Lamp Station (Renewal)	5	5	8,725	8,950	9,605	8,350	.11
Smog Check Advanced Emission Specialist (Initial)	20	20	29,360	32,640	43,000	18,320	.38
Smog Check Advanced Emission Specialist (Renewal)	20	20	138,780	138,880	113,920	6,800	1.21
Smog Check Basic Area Technician (Initial)	20	20	960	720	580	540	.01
Smog Check Basic Area Technician (Renewal)	20	20	5,800	6,320	4,600	120	.05
Smog Check Intern Technician (Initial) **	20	20	1,180	920	420	*	.01
Smog Check Inspector (Initial)	20	20	*	*	*	30,880	.09

Smog Check Inspector (Renewal)	20	20	*	*	*	145,640	.45
Smog Check Repair Only Technician (Initial)	20	20	*	*	*	11,460	.04
Smog Check Repair Only (Renewal)	20	20	*	*	*	132,820	.41
Brake & Lamp Adjuster (Initial) ***	10	10	19,390	21,640	22,240	17,310	.25

* Due to regulatory changes, the above notated areas are license types that were not in effect or license types that were discontinued.

** The Smog Check Intern Technician was a non-renewable two year license. An Intern license can only be issued to an applicant once.

*** The Brake & Lamp Adjuster is a four year license. An Initial application is processed every four years for adjusters that wish to maintain this license.

13. Describe Budget Change Proposals (BCPs) submitted by the bureau in the past four fiscal years.

The BCPs/finance letters contained in Table 5 below were implemented between FY 2008/09 and FY 2012/13.

Table 5. Budget Change Proposals (BCPs)

BCP ID #	Fiscal Year	Description of Purpose of BCP	Approved				
			Personnel Services			OE&E $ Approved	Total BCP $
			Number of Staff	Breakdown of Staff	$ Approved		
1111-01 L	2008/09	Special Fund augmentation to implement provisions of AB 1488 (Mendoza, Chapter 739, Statutes of 2007). Integration of lightweight diesel-powered vehicles into the Smog Check Program.	5.0	1.0 Air Quality Engineer I 4.0 Program Tech I	$400,000	-	$400,000
1111-09	2008/09	BAR Headquarters relocation	0.0	0.0	$0	$600,000 ($480,000 VIRF & $120,000 HPRRA)	$600,000 ($480,000 VIRF & $120,000 HPRRA)
1111-01 L *	2009/10	Expansion of funding to implement AB 619 (Emmerson, Chapter 420, Statutes of 2008). Amnesty for specially constructed vehicles.	2.5	2.0 Air Quality Engineer 0.5 Program Tech II	$193,000	$2.15million	$2.343 million
1111-02 SFL	2009/10	Expansion of funding to support AB 118 (Nunez, Chapter 750, Statutes of 2007). Establishes the Enhanced Fleet Modernization Program.	2.1	0.9 Air Quality Engineer II 0.9 Office Technician 0.3 Program Technician II	$201	$3.926 million	$4.127 million
			6.2	1.0 Associate Governmental Program Analyst 1.0 Air Quality Engineer II 3.5 Office Technician 1.0 Program Technician II	$479,000	$15.932 million	$16.411 million
			6.2	1.0 Associate Governmental Program Analyst 1.0 Air Quality Engineer II 3.5 Office Technician 1.0 Program Technician II	$479,000	$18.8 million	$19.279 million
1111-01 L	2010/12	Expansion of funding to implement AB 787 (Hill, Chapter 231, Statutes of 2010). EFMP low -income eligible consumers. Additionally, reduced HPRRA funding to the change in directed vehicle eligibility.	12.3	1.5 Air Quality Engineer II 1.5 Associate Governmental Program Analyst 4.0 Program Representative I 5.3 Program Technician II	$898,000	$21.259 million	$22.157 million
			- 8.0	- 8.0 Program Technician II	$425,000	-$7.268 million	- $7.693 million
1111-01 SFL	2012/13	Two-year limited term BCP to continue administration of the EFMP pursuant to AB 118 (Nunez, Chapter 750, Statutes of 2007). Technical changes.	0.0	0.0	0	$35.6 million	$35.6 million
1111-03	2012/13	Two-year limited term BCP to continue administration of the EFMP pursuant to AB 118 (Nunez, Chapter 750, Statutes of 2007).	12.0	12.0 Program Technician II	$625,000	$95,000	$720,000

* Requested as two-year limited term, but approved as one-year limited term.

Staffing Issues

14. Describe any staffing issues/challenges, i.e., vacancy rates, efforts to reclassify positions, staff turnover, recruitment and retention efforts, succession planning.

Statewide budget issues have necessitated BAR's Personnel Office to work diligently with DCA's Personnel Office and the California Department of Human Resources (CalHR) to successfully navigate the challenges related to recruitment and retention as stated below.

Vacancy Rates
BAR's average vacancy rate is under 3%. This low vacancy rate is due to recruitment and retention efforts by BAR that include continuous on-line testing for various classifications, such as the Program Representative I and Program Representative II series. This continuous on-line testing was developed in conjunction with both DCA and CalHR.

Efforts to Reclassify Positions
BAR has successfully reclassified positions to ensure that adequate appropriate classifications are available to meet BAR's operational needs.

Staff Turnover
BAR has identified key positions occupied by incumbents with less than two years until retirement. These incumbents are currently training staff in order to retain institutional knowledge that could be lost upon their retirement from state service.

BAR does not generally experience a high rate of turnover in staff, other than in entry-level office classifications.

Recruitment and Retention Efforts
BAR is successful in recruiting and retaining employees, as evidenced by an average vacancy rate of less than 3%. BAR encourages training for all employees. Training is offered to BAR employees through DCA's SOLID Training Unit, BAR's Technical Training Unit, and contracted training vendors.

Succession Planning
BAR utilizes DCA's Workforce and Succession Plan and has recently submitted a survey to DCA to assist in updating the current Succession Plan. BAR uses policies and procedures manuals as training tools for succession planning and knowledge transfer. BAR also contributes to DCA's Knowledge Management Center, which is an electronic repository of policies and procedures manuals on DCA's Intranet that is available to all departmental employees.

15. Describe the Bureau's staff development efforts and how much is spent annually on staff development (cf., Section 12, Attachment D).

BAR's internal and external training delivered 227 classes and 8,751 student hours. Classes delivered included Government Code procedures, Bargaining Unit mandates, professional development, and job related training at a cost of $85,957 for the 2012/13 fiscal year.

Section 4 – Licensing Program

16. What are the Bureau's performance targets/expectations for its licensing[2] program? Is the bureau meeting those expectations? If not, what is the bureau doing to improve performance?

The primary goal of BAR's Licensing Unit is to, in an efficient manner, register and license automotive repair dealers, Smog Check stations, Smog Check Inspectors and Technicians, lamp and brake stations, and brake and lamp

2 The term license in this document includes a license, certificate, or registration.

adjusters in California. The unit generally issues licenses, registrations, and certifications within the processing times shown in the chart below. Additionally, BAR processes the waiving of licensee renewal fees and requirements for Active Duty military service members, pursuant to Section 114.3 of the Business and Professions Code (AB 1588, Atkins, Chapter 742, Statutes of 2012).

License Type	Minimum Processing Days	Maximum Processing Days	FY 2011/12 Average Processing Days	FY 2012/13 Average Processing Days
Automotive Repair Dealer	17	97	35	29
Lamp Station	14	44	23	22
Brake Station	15	29	23	22
Lamp Adjuster	15	101	45	35
Brake Adjuster	21	103	45	35
Smog Check Station [1]	3	120	21	29
Smog Check Technician [2]	21	120	42	58
Smog Check Inspector [3]	2	112	51	59
Gold Shield/*STAR* Station	30	72	14	14/5 [4]

1 Average of all Smog Check station types (Test & Repair, Test Only, Repair Only).

2 FY 2012/13 uses averages for Smog Check Basic Area Technician and Smog Check Repair Technician licenses.

3 FY 2011/12 uses Advanced Emission Specialist license totals; FY 2012/13 uses the average of Advanced Emission Specialist and Smog Check Inspector license totals. In FY 2012/13 the Advanced Emissions Specialist license was discontinued.

4 14 days for Gold Shield stations and 5 days for STAR stations. The Gold Shield certification program was replaced by the STAR certification program, effective January 1, 2013.

BAR Licensing is also responsible for processing *STAR* certification applications. The *STAR* Program was fully implemented on January 1, 2013. The *STAR* Program inspects vehicles identified as being likely high or gross polluters. *STAR* certified stations must meet higher, performance based criteria as defined by BAR through regulation. There are over 5,000 stations that are currently certified under the *STAR* Program. BAR Licensing will continue to efficiently process *STAR* applications to ensure qualified station owners receive their certifications in a timely manner, and that motorists have numerous options when their vehicle is directed to a *STAR* station.

In addition, it was determined that BAR's Smog Check Technician classification and training needed updating, pursuant to the major studies described in the attachments. As a result, the previous Smog Check Technician license was divided into two license types – Smog Check Inspector and Smog Check Technician. BAR Licensing was prepared for the influx of Smog Check Technician applications during the transition to the two new license types, and processing of the applications went smoothly.

BAR has partnered with DCA on the BreEZe database project. The BreEZe system will allow for the online submittal of initial license applications and renewal processing. The BreEZe system will also incorporate online payment processing and allow for the collection of licensing statistics to better measure performance metrics.

17. Describe any increase or decrease in average time to process applications, administer exams and/or issue licenses. Have pending applications grown at a rate that exceeds completed applications? If so, what has been done to address them? What are the performance barriers and what improvement plans are in place? What has the Bureau done and what is the bureau going to do to address any performance issues, i.e., process efficiencies, regulations, BCP, legislation?

BAR currently processes applications within the mandated processing times, pursuant to CCR, Title 16, Section 3303.2 (as noted in the answer to question 16). BAR diligently continues to streamline processes and workload to maintain the timely issuance of registrations and licenses to the automotive industry.

18. How many licenses or registrations does the Bureau issue each year? How many renewals does the bureau issue each year?

The Licensing Unit has issued a total number of licenses, registrations and certificates for the following fiscal years:

FISCAL YEAR	INITIALS	RENEWALS
2009/10	6,930	47,961
2010/11	6,932	48,739
2011/12	7,053	47,101
2012/13	8,355	52,053

Table 6. Licensee Population

		FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13
Automotive Repair Dealer	Active	34,442	34,795	35,717	36,353
	Out-of-State	0	0	0	0
	Out-of-Country	0	0	0	0
	Delinquent	3,274	4,546	4,758	3,919
Smog Test and Repair Station	Active	4,913	4,831	4,787	4,914
	Out-of-State	0	0	0	0
	Out-of-Country	0	0	0	0
	Delinquent	620	599	644	605
Smog Test Only Station	Active	2,247	2,391	2,483	2,357
	Out-of-State	0	0	0	0
	Out-of-Country	0	0	0	0
	Delinquent	184	185	19	231
Smog Repair Only Station	Active	*	*	*	35
	Out of State	*	*	*	0
	Out of Country	*	*	*	0
	Delinquent	*	*	*	0
Brake and Lamp Station	Active	1,989	2,089	2,115	2,116
	Out-of-State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	244	265	266	272
Smog Check Advanced Emission Specialist (Ended July 31, 2012)	Active	14,344	14,643	14,865	9,002
	Out of State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	0	0	0	0

Smog Check Basic Area Technician (Ended July 31, 2012)	Active	647	631	611	332
	Out of State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	0	0	0	0
Smog Check Intern Technician	Active	44	37	35	*
	Out of State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	0	0	0	0
Smog Check Inspector (New license type effective August 1, 2012)	Active	*	*	*	6,498
	Out of State	*	*	*	0
	Out of Country	*	*	*	0
	Delinquent	*	*	*	0
Smog Check Repair Technician (New license type effective August 1, 2012)	Active	*	*	*	5,551
	Out of State	*	*	*	0
	Out of Country	*	*	*	0
	Delinquent	*	*	*	0
Brake and Lamp Adjusters	Active	3,418	3,356	3,203	3,166
	Out of State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	0	0	0	0
Gold Shield Certificates (Ended December 31, 2012)	Active	548	764	534	504
	Out of State	0	0	0	0
	Out of Country	0	0	0	0
	Delinquent	0	0	0	0
STAR Certificates (Started January 1, 2013)	Active	*	*	*	2,708
	Out of State	*	*	*	0
	Out of Country	*	*	*	0
	Delinquent	*	*	*	0

* Due to regulatory changes, the above notated areas are license types that were not in effect or a license type that was inactivated.

Table 7a. Licensing Data by Type

Fiscal Year (FY)	Application Type	Received	Approved	Closed	Issued	Pending Applications			Cycle Times		
						Total (Close of FY) [1]	Outside Bureau control [2]	Within Bureau control [2]	Complete Apps	Incomplete Apps	Combined, IF unable to separate out
FY 2010/11	Automotive Repair Dealer	3,895	N/A	N/A	3,303	592	N/A	N/A	N/A	N/A	N/A
	Renewal	* [3]	N/A	N/A	33,295	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Test and Repair Station	373	N/A	N/A	330	43	N/A	N/A	N/A	N/A	N/A
	Renewal	* [3]	N/A	N/A	4,501	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Test Only Station	491	N/A	N/A	443	48	N/A	N/A	N/A	N/A	N/A
	Renewal	* [3]	N/A	N/A	1,893	N/A	N/A	N/A	N/A	N/A	N/A
	Brake & Lamp Station	265	N/A	N/A	217	48	N/A	N/A	N/A	N/A	N/A
	Renewal	* [3]	N/A	N/A	1,790	N/A	N/A	N/A	N/A	N/A	N/A
	Business Renewals [3]	4,1479	N/A	N/A	41,479	0	N/A	N/A	N/A	N/A	N/A
	Smog Check Advanced Emission Specialist	1,632	N/A	N/A	1,126	506	N/A	N/A	N/A	N/A	N/A
	Renewal	6,944	N/A	N/A	6,944	0	N/A	N/A	N/A	N/A	N/A
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Basic Area Technician	36	N/A	N/A	17	19	N/A	N/A	N/A	N/A	N/A
	Renewal	316	N/A	N/A	316	0	N/A	N/A	N/A	N/A	N/A
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Intern	46	N/A	N/A	12	34	N/A	N/A	N/A	N/A	N/A
	Brake & Lamp Adjuster	2,164	N/A	N/A	859	1,305	N/A	N/A	N/A	N/A	N/A
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gold Shield Certificates	345	N/A	N/A	85	260	N/A	N/A	N/A	N/A	N/A

Fiscal Year (FY)	Application Type	Received	Approved	Closed	Issued	Pending Applications			Cycle Times		
						Total (Close of FY) [1]	Outside Bureau control [2]	Within Bureau control [2]	Complete Apps	Incomplete Apps	Combined, IF unable to separate out
FY 2011/12	Automotive Repair Dealer	4,104	N/A	N/A	3,884	220	N/A	N/A	N/A	N/A	35 days
	Renewal	32,798	N/A	N/A	32,798	0	N/A	N/A	N/A	N/A	2-4 weeks
	Smog Check Test and Repair Station	369	N/A	N/A	375	N/A	N/A	N/A	N/A	N/A	21 days
	Renewal	4,520	N/A	N/A	4,520	0	N/A	N/A	N/A	N/A	2-4 weeks
	Smog Check Test Only Station	494	N/A	N/A	483	11	N/A	N/A	N/A	N/A	20 days
	Renewal	1,936	N/A	N/A	1,936	0	N/A	N/A	N/A	N/A	2-4 weeks
	Brake & Lamp Station	294	N/A	N/A	251	43	N/A	N/A	N/A	N/A	23 days
	Renewal	1,921	N/A	N/A	1,921	N/A	N/A	N/A	N/A	N/A	2-4 weeks
	Business Renewals	41,175	N/A	N/A	41,175	0	N/A	N/A	N/A	N/A	N/A
	Smog Check Advanced Emission Specialist	2,150	N/A	N/A	1,129	1,021	N/A	N/A	N/A	N/A	51 days
	Renewal	5,696	N/A	N/A	5,696	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Basic Area Technician	29	N/A	N/A	19	10	N/A	N/A	N/A	N/A	42 days
	Renewal	230	N/A	N/A	230	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-
	Smog Check Intern	21	N/A	N/A	17	4	N/A	N/A	N/A	N/A	19 days
	Brake & Lamp Adjuster	2,224	N/A	N/A	838	1,386	N/A	N/A	N/A	N/A	45 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-
	Gold Shield Certificates	215	N/A	N/A	57	158	N/A	N/A	N/A	N/A	14 days

Fiscal Year (FY)	Application Type	Received	Approved	Closed	Issued	Pending Applications			Cycle Times		
						Total (Close of FY) [1]	Outside Bureau control [2]	Within Bureau control [2]	Complete Apps	Incomplete Apps	Combined, IF unable to separate out
FY 2012/13	Automotive Repair Dealer	4,464	N/A	N/A	3,949	662	N/A	N/A	N/A	N/A	29 days
	Renewal	29,528	N/A	N/A	29,528	0	N/A	N/A	N/A	N/A	10-20 days
	Smog Check Test and Repair Station	721	N/A	N/A	608	125	N/A	N/A	N/A	N/A	46 days
	Renewal	3,926	N/A	N/A	3,926	0	N/A	N/A	N/A	N/A	10-20 days
	Smog Check Test Only Station	503	N/A	N/A	464	48	N/A	N/A	N/A	N/A	24 days
	Renewal	1,715	N/A	N/A	1,715	0	N/A	N/A	N/A	N/A	10-20 days
	Smog Check Repair Only	70	N/A	N/A	63	6	N/A	N/A	N/A	N/A	18 days
	Renewal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Brake & Lamp Station	369	N/A	N/A	275	99	N/A	N/A	N/A	N/A	22 days
	Renewal	1,670	N/A	N/A	1,670	0	N/A	N/A	N/A	N/A	10-20 days
	Business Renewals	36,839	N/A	N/A	36,839	0	N/A	N/A	N/A	N/A	N/A
	Smog Check Advanced Emission Specialist	909	N/A	N/A	522	395	N/A	N/A	N/A	N/A	75 days
	Renewal	345	N/A	N/A	345	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Basic Area Technician	27	N/A	N/A	11	16	N/A	N/A	N/A	N/A	66 days
	Renewal	6	N/A	N/A	6	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Inspector	1,291	N/A	N/A	661	792	N/A	N/A	N/A	N/A	43 days
	Renewal	7,760	N/A	N/A	7,760	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Smog Check Repair Technician	586	N/A	N/A	156	392	N/A	N/A	N/A	N/A	49 days
	Renewal	7,103	N/A	N/A	7,103	0	N/A	N/A	N/A	N/A	10 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Brake & Lamp Adjuster	1,809	N/A	N/A	799	932	N/A	N/A	N/A	N/A	35 days
	Exam	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Gold Shield Certificate [4]	29	N/A	N/A	17	12	N/A	N/A	N/A	N/A	14 days
	STAR Certificate [5]	5,862	N/A	N/A	2,708	4,247	N/A	N/A	N/A	N/A	5 days

1 The column for "Total (Close of FY)" is a combined number of pending, deficient, abandoned, and denied applications.
2 This data is not tracked by BAR.
3 Statistics for business renewals have only been tracked since July 2011.
4 The Gold Shield certification program ended on December 31, 2012.
5 The STAR certification program became effective on January 1, 2013.

Table 7b. Total Licensing Data			
	FY 2010/11	FY 2011/12	FY 2012/13
Initial Licensing Data:			
Initial License/Initial Exam Applications Received	9,247	9,810	15,832 [2]
Initial License/Initial Exam Applications Approved	N/A	N/A	N/A
Initial License/Initial Exam Applications Closed	N/A	N/A	N/A
License Issued	6,932	7,053	10,216 [2]
Initial License/Initial Exam Pending Application Data: (See note below)			
Pending Applications (total at close of FY)	N/A	N/A	N/A
Pending Applications (outside of Bureau control) [1]	N/A	N/A	N/A
Pending Applications (within the Bureau control) [1]	N/A	N/A	N/A
Initial License/Initial Exam Cycle Time Data (WEIGHTED AVERAGE):			
Average Days to Application Approval (All - Complete/ Incomplete)	N/A	35 days	41 days
Average Days to Application Approval (Incomplete applications) [1]	N/A	N/A	N/A
Average Days to Application Approval (Complete applications) [1]	N/A	N/A	N/A
License Renewal Data:			
License Renewed	48,739	47,101	52,053

1 This data is not tracked by BAR.
2 The notable difference in applications received and licenses issued for fiscal year 2012/2013 is due to STAR applications in pending, deficient, abandoned, and denied status.
Note: Exam Pending Application Data - BAR does not have a system to track applicants who have not taken the licensing examination.

19. How does the Bureau verify information provided by the applicant?

Applicants are requested to disclose all prior criminal convictions or administrative discipline, including Smog Check citations, as part of the application process. BAR's Enforcement Division reviews prior disciplinary and/or criminal history to determine if the initial or renewal license should be granted.

a. **Does the bureau fingerprint all applicants?**

No. BAR is not statutorily authorized to fingerprint applicants.

b. **Have all current licensees been fingerprinted? If not, explain.**

No. As stated above, BAR is not statutorily authorized to fingerprint applicants.

c. **Is there a national databank relating to disciplinary actions?**

No.

Does the Bureau check the national databank prior to issuing a license?

N/A

Renewing a license?

N/A

d. **Is there a national databank relating to disciplinary actions?**

No.

Does the Bureau check the national databank prior to issuing a license?

N/A

Renewing a license?

N/A

e. **Does the Bureau require primary source documentation?**

The applicant is required to provide a detailed explanation of any criminal convictions. If it is found that the applicant knowingly made a false statement of fact, the application may be denied pursuant to B&P Code Section 480(c). BAR does not have DOJ access to review the criminal background of applicants.

20. Describe the Bureau's legal requirement and process for out-of-state and out-of-country applicants to obtain licensure.

BAR's licensing requirements and licensing application processes are the same for out-of-state and out-of country applicants as they are for in-state applicants. BAR recently implemented expedited application processing for the spouses of Active Duty military service members provided those spouses hold a similar license in any other state or United States territory, pursuant to AB 1904 (Block, Chapter 399, Statutes of 2012).

21. Does the Bureau send No Longer Interested notifications to DOJ on a regular and ongoing basis? Is this done electronically? Is there a backlog? If so, describe the extent and efforts to address the backlog.

No. BAR does not have statutory authority to fingerprint applicants.

Examinations

Table 8. Examination Data

California Examination (include multiple language) if any:

License Type		Advanced Emission Specialist	Basic Area Technician	Smog Check Inspector	Smog Check Repair Technician	Brake Adjuster	Lamp Adjuster
Exam Title		**Advanced Emission Specialist**	**Basic Emission Specialist**	**Smog Check Inspector**	**Smog Check Repair Technician**	**Brake Adjuster**	**Lamp Adjuster**
FY 2009/10	# of 1st Time Candidates	1487	31	(1)	(1)	647	680
	Pass %	65	52	(1)	(1)	79	60
FY 2010/11	# of 1st Time Candidates	1519	30	(1)	(1)	646	695
	Pass %	66	40	(1)	(1)	73	54
FY 2011/12	# of 1st Time Candidates	1522	26	(1)	(1)	641	752
	Pass %	66	58	(1)	(1)	66	49
FY 2012/13	# of 1st Time Candidates	771 [2]	23 [2]	979	301	598	710
	Pass %	41(2)	18(2)	56	44	71	46
Date of Last OA		2009					
Name of OA Developer		Donnoe & Associates					
Target OA Date		2014				2014	2014

National Examination (include multiple language) if any: (3)

License Type							
Exam Title							
FY 2009/10	# of 1st Time Candidates						
	Pass %						
FY 2010/11	# of 1st Time Candidates						
	Pass %						
FY 2011/12	# of 1st Time Candidates						
	Pass %						
FY 2012/13	# of 1st Time Candidates						
	Pass %						
Date of Last OA							
Name of OA Developer							
Target OA Date							

1 Due to regulatory changes, the above notated areas on Table 8 are license types that became effective August 1, 2012.

2 Due to regulatory changes, the above notated areas on Table 8 are license types that were phased out effective August 1, 2012.

3 BAR does not administer any national examinations. However, the Smog Check Inspector and Smog Check Repair Technician license may elect to take Automotive Service Excellence (ASE) courses as one option to meet skill, knowledge and experience requirements in order to take the California Smog examination.

22. Describe the examinations required for licensure. Is a national examination used? Is a California specific examination required?

BAR's multiple-choice questions for licensing examinations are developed using industry Subject Matter Experts in cooperation with the Department's Office of Professional Examination Services (OPES). BAR administers six licensing examinations described below:

- BAR's Smog Check Inspector examination consists of 100 questions focused on performing accurate visual, functional, tailpipe, smoke and evaporative emission tests. It was last updated in August, 2013.
- BAR's Smog Check Repair Technician examination consists of 100 questions focused on appropriate diagnostic and repair strategies for vehicles that have failed a Smog Check inspection. It was last updated in August, 2013.
- BAR's Brake Adjuster (A) examination consists of 125 questions focused on appropriate strategies for performing accurate brake system inspections and adjustments on all motor vehicles. It was last updated in June, 2011.
- BAR's Brake Adjuster (B) examination consists of 125 questions focused on appropriate strategies for performing accurate brake system inspections and adjustments on all heavy duty trucks greater than 14,000 pounds gross vehicle weight. It was last updated in June, 2011.
- BAR's Brake Adjuster (C) examination consists of 125 questions focused on appropriate strategies for performing accurate brake system inspections and adjustments on all light duty motor vehicles (less than 10,000 pounds gross vehicle weight) and motorcycles. It was last updated in June, 2011.
- BAR's Lamp Adjuster examination consists of 99 questions focused on performing accurate lamp system inspection and adjustments on all motor vehicles. It was last updated in March, 2011.

Only a California examination is required for license types that require an examination (See notation regarding National Examination in Table 8 on page 23).

23. What are pass rates for first time vs. retakes in the past 4 fiscal years? (Refer to Table 8. Examination Data)

Statistics collected regarding pass rates do not report retest pass rates unique to individual applicants. However, the BreEZe database project will allow for the capture and analysis of this data.

24. Is the Bureau using computer-based testing? If so, for which tests? Describe how it works. Where is it available? How often are tests administered?

BAR utilizes computer-based testing for all licensing examinations. Examinations include: Smog Check Inspector, Smog Check Repair Technician, Brake Adjuster, and Lamp Adjuster. These examinations are developed by BAR and provided by DCA contracted vendor, PSI. The examinations are available throughout California six days per week, excluding major holidays.

Qualified applicants schedule their examination(s) directly with the examination contractor via the internet or telephone. Examinees receive their score immediately following the examination. If the examinee passes the examination, the contractor will prepare and mail both a wall license and wallet badge. Examinations sites are located in Anaheim, Atascadero, Burbank, Carson, El Monte, Fresno, Hayward, Redding, Riverside, Sacramento, San Diego, San Francisco, Santa Rosa, Ventura, Tulare, Santa Clara, and Walnut Creek.

25. Are there existing statutes that hinder the efficient and effective processing of applications and/or examinations? If so, please describe.

No. BAR's Licensing Unit and examination contractor are able to process applications and examinations in an efficient and effective manner. BAR has some minor data-gathering difficulties (i.e. license exam re-take rates) that will be resolved by the BreEZe project.

School Approvals

26. Describe legal requirements regarding school approval. Who approves your schools? What role does BPPE have in approving schools? How does the bureau work with BPPE in the school approval process?

As part of the administration of the Smog Check Program, Health and Safety Code Sections 44031.5, 44045.5 and 44045.6 require BAR to certify schools that provide training to Smog Check Repair Inspectors and Technicians. To that end, BAR has established, through regulations, requirements that training institutions must meet to qualify for BAR certification. Approval by the Bureau for Private Postsecondary Education (BPPE) is a part of those qualification requirements. Specifically, prospective training institutions must obtain BPPE approval or, as applicable, an exemption of approval from BPPE. BPPE serves to screen private training institutions to ensure student protection mechanisms are in place. BAR's requirements for certification focus on the institution's technical capabilities, including an inspection of their facility to verify that it has the required tools, equipment, vehicles, and instructors.

27. How many schools are approved by the Bureau? How often are schools reviewed?

As of May 2013, BAR has certified 111 training institutions. These training institutions' qualifications are reviewed annually upon submission of their renewal applications.

28. What are the Bureau's legal requirements regarding approval of international schools?

N/A

Continuing Education (CE)/Competency Requirements

29. Describe the Bureau's continuing education requirements, if any. Describe any changes made by the bureau since the last review.

a. **How does the Bureau verify CE or other competency requirements?**

For license renewal, Smog Check Inspectors are required to complete four hours of update training every two years. Smog Check Repair Technicians are required to attend 16 hours of update training every two years. If the licensee holds both the inspector and repair technician licenses, they are required to complete a total of 16 hours of update training every two years. BAR certified instructors conduct CE and enter each student's name into a BAR database upon the licensee's successful completion of the course.

b. **Does the Bureau conduct CE audits of its licensees? Describe the Bureau's policy on CE audits?**

Instead of an audit, licensees receive a license renewal after BAR's confirmation on the Standards and Training (S&T) Web site of their completion of update training. Certified instructors enter verification of course completion directly into the S&T Web site.

c. **What are the consequences for failing a CE audit?**

The Smog Check Inspector or Repair Technician license is not renewed.

d. **How many CE audits were conducted in the past four years?**

BAR renews approximately 6,000 licenses annually. As previously mentioned, due to BAR's renewal process, it does not require audits of the information provided by licensees regarding completed CE as it receives this information directly from the certified CE providers through the S&T website rather than from licensees.

How many fails?

BAR implemented CE training in August 2012. BAR does not yet have the ability to track how many licensees fail CE training, but is implementing a technology change that will allow BAR to gather this data. Typically, if a licensee wants to continue practicing in the trade, they will retake CE training (often with the original provider) until they pass.

e. **What is the Bureau's course approval policy?**

BAR certified instructors submit updated training classes to BAR for approval.

f. **Who approves CE providers?**

BAR. There are two different approvals for CE providers: One is for the school and the second is for the instructor.

Private schools that apply to become BAR certified institutions must first contact BPPE and request an *Application for Approval to Operate an Institution Non-Accredited* or an *Application for Verification of Exempt Status*.

BAR completes an inspection of all applicant schools to ensure the schools meet equipment, educational materials, lecture, and laboratory facilities requirements as provided in California Code of Regulations, Title 16, Section 3340.32.

To become a BAR certified instructor, the applicant must meet certain requirements, which differ depending on whether or not the applicant is a credentialed teacher or non-credentialed teacher. The requirements are as follows:

1. All applicants must possess certificates in the areas of Electrical/Electronic Systems (A6), Engine Performance (A8), and Advanced Engine Performance (L1) from the National Institute of Automotive Service Excellence (ASE);

2. Credentialed applicants must:

    i. Possess a teaching credential in automotive technology that is recognized by the California Department of Education; or

    ii. Meet the California Community College eligibility requirements for teaching an engine performance course.

3. Non-credentialed Applicants must:

    i. Have a minimum of two years' experience in the engine performance area and a Baccalaureate degree in vocational education (emphasis in automotive technology); or,

    ii. Have a minimum of four years' experience in the engine performance area and an Associate of Arts degree or Certificate in automotive technology; or,

    iii. Have a minimum of six years' experience in the engine performance area.

    iv. In addition to the experience/education requirements noted above, the non-credentialed applicant must pass a written exam administered by the department and must give a short instructional presentation in front of an evaluation committee. The evaluation committee is usually comprised of at least one BAR staff and two contracted Subject Matter Experts (SME). Each member of the evaluation committee ranks the applicant in 20 areas. The applicant must score a passing result to receive BAR certification.

g. **Who approves CE courses?**

A group of SMEs, and ultimately BAR, issues a certification of approval.

h. **If the Bureau approves them, what is the Bureau application review process?**

To obtain CE or BAR update course approval, the instructors submit the course to BAR staff to ensure all documents are included in the training package. BAR staff then assigns assessment responsibilities to BAR contracted SMEs. SMEs are instructors actively teaching in community colleges or private schools. If assigned SMEs approve the course, the course is certified by BAR for use by the school that submitted the course for certification. BAR then assigns a course number that can be tracked by BAR.

i. **How many applications for CE providers and courses were received?**

In the last 12 months, BAR received four applications for schools, 28 applications for instructors, and 24 applications for course approval.

How many were approved?

One school was approved and the other three are awaiting approval from BPPE. Nine instructors passed both the written exam and the presentation and were subsequently certified. 17 of the 24 courses have been approved, four have been withdrawn by the author, and three are in various stages of the approval process.

j. **Does the Bureau audit CE providers?**

Yes. BAR currently conducts random, unannounced audits of CE providers. Audits consist of a tool and equipment inventory, an exam security inspection, and intermittent classroom attendance by BAR staff.

k. **Describe the Bureau's effort, if any, to review its CE policy for purpose of moving toward performance based assessments of the licensees continuing competence.**

In January 2013, BAR implemented the *STAR* Program, which is essentially a performance metric to evaluate licensed Smog Check Inspector performance. Only inspectors that meet the *STAR* qualification criteria receive a *STAR* certification that allows them to inspect directed vehicles that are typically the highest emitting vehicles in California's fleet.

Section 5 – Enforcement Program

30. What are the Bureau's performance targets/expectations for its enforcement program? Is the Bureau meeting those expectations? If not, what is the bureau doing to improve performance?

Performance measures for the Enforcement Division of BAR are defined by DCA as part of the Consumer Protection Enforcement Initiative (CPEI) and focus on timely response to consumers and the pursuit of prompt disciplinary action against those found to be in violation of the Act.

Consumers initially contact BAR through the complaint investigation and mediation process. During the last review, BAR reported transferring between 37% and 42% of its consumer complaints to DCA's mediation centers for resolution. In FY 2011/12 and FY 2012/13, BAR has retained 98% of complaints for investigation and mediation by BAR Field Offices.

For all complaints received, BAR has a goal of assigning complaints received to an investigator within seven days. Currently, BAR averages the assignment of complaints within four days and is meeting its expectations in this area. Concerning the time necessary to investigate and mediate a consumer compliant, BAR's expectation is that complaints are closed within 60 days of receipt. For FY 2010/11, FY 2011/12, and FY 2012/13 to date, BAR averaged 48 days, 47 days, and 48 days, respectively. Again, BAR is meeting its expectations in this area. Finally, BAR strives for an 85% positive result in its consumer satisfaction survey. Currently, 87% of consumers would refer a family member or friend to BAR, as indicated in the Consumer Satisfaction Survey Results in response to item 7 on page 6. BAR considers the response to this item an accurate measure of consumer satisfaction because the contentious nature of a complaint skews the responses to other survey questions. Again, BAR is meeting its expectations in this area.

BAR's goal for completion of formal disciplinary cases, as defined by the CPEI, is 540 days from the date the investigation is opened to the date of the resulting disciplinary order or other action. In FY 2010/11, the average was 535 days; in FY 2011/12, the average was 652 days; and for FY 2012/13, the average was 560 days. The keys to achieving this improvement have been the implementation of a streamlined case review process, a beginning to end case tracking process that identifies areas of inefficiency, and collaborating with the Office of the Attorney General to expedite adjudication of BAR cases. It is important to note that the goal of 540 days includes the total time from the day BAR initiates an investigation until the final effective date of the administrative action. This includes time necessary for the Attorney General's office to prepare an accusation and the time necessary to schedule and hold an administrative hearing. BAR's internal goal for completion of an investigation is 180 days to allow time for our partner agencies to complete adjudication. For Fiscal Year 2012/13 to date, BAR's average case completion time is 176 days.

BAR's expectation for implementing probation monitoring with new probationary licensees or registrants is to initiate contact within 10 days of the start date of the probation. Currently, BAR initiates contact in five days. BAR's goal for initiating a response to a probation violation is ten days. However, the current response time is 29 days. Because identification and response to a suspected probation violation requires further investigative work by BAR, this number will nearly always be higher than the goal of 10 days. Violations are only considered an allegation until BAR performs an investigation confirming that a violation occurred prior to initiating a response.

31. Explain trends in enforcement data and the Bureau's efforts to address any increase in volume, timeframes, ratio of closure to pending, or other challenges. What are the performance barriers? What improvement plans are in place? What has the bureau done and what is the bureau going to do to address these issues, i.e., process efficiencies, regulations, BCP, legislation?

With the *STAR* Program becoming effective as of January 1, 2013, the Enforcement Division has experienced an increase in the volume of requests for further administrative review of applications for participation in the *STAR* Program. This has been partially addressed through an informal administrative review process.

Another trend in the enforcement data is the increase in the number of cases adjudicated within the first year of filing with the Attorney General's office. In FY 2009/10, only 20% of BAR's cases were adjudicated within the first year of submittal to the Attorney General's office. In FY 2012/13, that number increased to 34%. This is an example of improvements that have been made by collaborating with the Attorney General's office to identify and take advantage of mutual opportunities.

In 2012/13, there has been a noticeable decrease in BAR enforcement activity, most noticeably in the issuance of citations and fines pursuant to the Smog Check Program. This is due to the fact that in November of 2012, BAR began initiating service contracts with confidential undercover operators. This involved a six month contracting process. Working with DCA, BAR was able to develop and implement these procedures in May of 2013; however, the six months during which BAR was unable to utilize civilian operators resulted in a substantial decrease in enforcement actions.

See Tables 9a, 9b, 9c, and 10 on the following pages for Enforcement data and actions.

Table 9a. Enforcement Statistics			
	FY 2010/11	**FY 2011/12**	**FY 2012/13**
COMPLAINT			
Intake (Use CAS Report EM 10)			
Received	18,531	19,076	17,157
Closed	18,047	18,105	17,548
Referred to BAR Field Office for Investigation/Mediation	17,814	18,608	16,862
Average Time to Close	48	47	48
Pending (close of FY)	1,974	2,489	1,809
Source of Complaint (Use CAS Report 091)			
Public	16,119	15,486	15,048
Licensee/Professional Groups	12	4	3
Governmental Agencies	8	2	3
Internal/Other	2392	3584	2103
Conviction (CONV) / Arrest (Use CAS Report EM 10)			
CONV Received	N/A	N/A	N/A
CONV Closed	N/A	N/A	N/A
Average Time to Close	N/A	N/A	N/A
CONV Pending (close of FY)	N/A	N/A	N/A
Note: Convictions and Arrests take place as a result of BAR investigations, not complaints. Consequently, BAR has no data to report here.			
LICENSE DENIAL (Use CAS Reports EM 10 and 095)			
License Applications Denied	26	121	290
Statements of Issues (SOI) Filed	21	25	55
SOIs Withdrawn	7	5	14
SOIs Dismissed	0	0	0
SOIs Declined	0	0	0
Average Days SOI	191	149	202
ACCUSATION (Use CAS Report EM 10)			
Accusations Filed	162	234	133
Accusations Withdrawn	2	2	9
Accusations Dismissed	0	0	0
Accusations Declined	0	0	0
Average Days Accusations*	258	177	398
AG Cases Pending (close of FY)	276	327	251

* **Note:** *Average Days Accusations* are the number of days from the date the case is opened to the date the accusation is served on the respondent. This includes the period during which the Attorney General is preparing the decision.

Table 9b. Enforcement Statistics (continued)			
	FY 2010/11	FY 2011/12	FY 2012/13
DISCIPLINE			
Disciplinary Actions (Use CAS Report EM 10)			
Proposed/Default Decisions	59	105	95
Stipulations	160	99	122
Average Days to Complete	535	652	556
AG Cases Initiated	261	282	185
AG Cases Pending (close of FY)	276	327	251
Disciplinary Outcomes (Use CAS Report 096)			
Revocation	249	416	372
Voluntary Surrender	0	0	0
Suspension	0	0	2
Probation with Suspension	57	79	109
Probation	103	55	55
Probationary License Issued	0	0	0
Other	6	15	28
PROBATION			
New Probationers	184	151	183
Probations Successfully Completed	122	109	254
Probationers (close of FY)	347	377	307
Petitions to Revoke Probation	10	14	11
Probations Revoked	8	12	12
Probations Modified	0	0	1
Probations Extended	1	2	0
Probationers Subject to Drug Testing	0	0	0
Drug Tests Ordered	0	0	0
Positive Drug Tests	0	0	0
Petition for Reinstatement Granted	0	0	0
DIVERSION			
New Participants	N/A	N/A	N/A
Successful Completions	N/A	N/A	N/A
Participants (close of FY)	N/A	N/A	N/A
Terminations	N/A	N/A	N/A
Terminations for Public Threat	N/A	N/A	N/A
Drug Tests Ordered	N/A	N/A	N/A

Note: BAR does not utilize a diversion program.

Table 9c. Enforcement Statistics (continued)			
	FY 2010/11	**FY 2011/12**	**FY 2012/13**
INVESTIGATION			
BAR Field Investigations			
Opened (Includes Smog Check Citations)	2,222	3,024	1,774
Closed	2,264	3,033	1,862
Average days to close	184	134	277
Pending (close of FY)	296	261	333
Desk Investigations * (Use CAS Report EM 10)			
Closed	827	108	20
Average days to close	30	46	33
Pending (close of FY)	22	6	2
Non-Sworn Investigation (Use CAS Report EM 10)			
Sworn Investigation			
Note: All BAR investigations are conducted by non-sworn Program Representatives. Consequently, there is no delineation between these numbers and BAR is not reporting.			
COMPLIANCE ACTION (Use CAS Report 096)			
ISO & TRO Issued (# OF LICENSES AFFECTED) **	20	91	45
PC 23 Orders Requested	1	5	3
Other Suspension Orders	0	0	0
Citations and Orders of Abatement for Unlicensed Activity	0	366	335
Amount of Fines Assessed for Unlicensed Activity	0	$2,500	$9,500
Amount Collected	0	0	$5,000
CITATION AND FINE (Use CAS Report EM 10 and 095)			
Citations Issued (Includes Citations for Unlicensed Activity)	1,566	2,204	1,112
Average Days to Complete	41	23	22
Amount of Fines Assessed	$741,500.00	$584,500.00	$523,000.00
Reduced, Withdrawn, Dismissed	$10,500.00	$1,500.00	$5,000.00
Amount Collected	$719,500.00	$727,500.00	$448,250.00
CRIMINAL ACTION			
Referred for Criminal Prosecution	131	186	63

* Note: Desk investigations are conducted by the Complaint Mediation center at the Department level. Beginning in 2011, BAR began retaining all jurisdictional complaints for referral to field Enforcement staff in order to ensure the most effective investigation and mediation services for consumers. This resulted in a large decrease in the number of desk investigations.

** In FY 2011/12, BAR's Enforcement Division began submitting *clean-plugging (*the fraudulent certification of a vehicle using the computer scan data from another vehicle) cases based upon OBD II data. These cases of fraudulent inspections resulted in an initial increase in requests for Interim Suspension Orders.

Table 10. Enforcement Aging						
	FY 2009/10	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**	**Cases Closed**	**% of Total Cases**
Number of Attorney General Cases Closed						
Closed Within:						
1 Year	28	106	28	85	**247**	30%
2 Years	87	83	105	94	**369**	45%
3 Years	21	26	62	56	**165**	20%
4 Years	2	8	6	12	**28**	3%
Over 4 Years	1	2	4	0	**7**	1%
Total Cases Closed	**139**	**225**	**205**	**247**	**816**	
Total Number of Investigations						
Submitted to the Attorney General's Office Within:						
90 Days	60	146	176	85	**467**	43%
180 Days	59	82	85	84	**310**	28%
1 Year	47	53	71	58	**229**	21%
2 Years	17	15	24	28	**84**	8%
3 Years	1	0	0	2	**3**	0%
Over 3 Years	0	0	0	0	**0**	0%
Total Cases Closed	**184**	**296**	**356**	**257**	**1093**	

32. What do overall statistics show as to increases or decreases in disciplinary action since last review.

Since the last sunset review, BAR has seen a substantial increase in formal investigations, administrative actions, license revocations, and citations, with the exception of FY2012/13, where there was a decrease in enforcement actions due to the reduced availability of civilian operators to execute undercover operations. Many of these increases are due to the aforementioned retention of the substantial majority of consumer complaints, enhanced citation authority, and collaboration with prosecuting authorities.

33. How are cases prioritized? What is the Bureau's compliant prioritization policy? Is it different from DCA's *Complaint Prioritization Guidelines for Health Care Agencies* (August 31, 2009)? If so, explain why.

Pursuant to Business and Professions Code section 494 and Health and Safety Code section 44072.10, BAR may seek an Interim Suspension Order (ISO) to immediately suspend the license of a facility and/or technician if the department determines that continued misconduct would endanger the public's health, safety, or welfare. BAR does not have formal Complaint Prioritization Guidelines, because it is not a healing arts bureau.

34. Are there mandatory reporting requirements? For example, requiring local officials or organizations, or other professionals to report violations, or for civil courts to report actions taken against a licensee. Are there problems with receiving the required reports? If so, what could be done to correct the problems?

External law enforcement entities and civil courts are not statutorily required to provide BAR with notifications of violations related to BAR's licensees.

35. Does the Bureau operate with a statute of limitations? If so, please describe and provide citation. If so, how many cases were lost due to statute of limitations? If not, what is the Bureau's policy on statute of limitations?

Pursuant to Business and Professions Code sections 9884.20 and 9889.8, BAR has three years from the occurrence of, or two years after discovery of, an alleged action, that is grounds for disciplinary action to file an accusation.

BAR has not lost any cases due to technicalities associated with exceeding its statutes of limitation.

36. Describe the Bureau's efforts to address unlicensed activity and the underground economy.

Since the implementation of regulations for issuing citations for unlicensed activity became effective in October 2011, BAR has issued nearly 700 citations to unlicensed persons and facilities.

BAR is an active participant in the Governor's *Labor Enforcement Task Force* (LETF) and partners with the other agencies in the LETF to perform compliance sweeps numerous times each year. BAR also continuously monitors online listings and advertisements such as *Craigslist, Angie's List*, *Penny Saver,* etc. to identify and target potential unlicensed activities. BAR sets up covert sting operations to engage these operators and take appropriate action.

Cite and Fine

37. Discuss the extent to which the Bureau has used its cite and fine authority. Discuss any changes from last review and last time regulations were updated. Has the Bureau increased its maximum fines to the $5,000 statutory limit?

BAR continuously utilizes its cite and fine authority to enforce the provisions of the Smog Check Program. On July 10, 2012, regulations became effective to expand the list of citable Smog Check violations for which a citation and fine are now authorized. Additionally, these regulations increased the maximum amount of fines up to the $5,000 statutory limit.

38. How is cite and fine used? What types of violations are the basis for citation and fine?

The predominant number of citations and fines are issued pursuant to the Health and Safety Code for improper Smog Check inspections. These citations are issued as a means of promoting compliance with the Laws and Regulations governing the Smog Check Program. Additionally, in November of 2011, BAR began issuing citations and orders of abatement or monetary fines to individuals engaged in unlicensed activities.

39. How many informal office conferences, Disciplinary Review Committees reviews and/or Administrative Procedure Act appeals in the last 4 fiscal years?

BAR utilizes informal citation conferences and formal citation appeal hearings pursuant to the Administrative Procedures Act to afford respondents the opportunity to appeal a citation. The following table below details the appeals received for the last four fiscal years.

Citation Appeals				
APPEAL TYPE	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**
Informal Citation Conference	0*	0*	3	50
Administrative Procedure Act Appeals	126	315	226	127

* Informal conference authority effective January 1, 2011 pursuant to Health and Safety Code Section 44051; statute added by AB 2289.

40. What are the 5 most common violations for which citations are issued?

The following code sections (in order of most issued to least issued) account for all, or nearly all, citations issued by BAR.

Code/Section	Description
Health and Safety Code Section 44012	Smog Test Procedures (Station)
Health and Safety Code Section 44032	Improper Test Procedures (Technician)
Business and Professions Code Section 9884.6	Requirement to Register to Perform Automotive Repairs for Compensation
Health and Safety Code Section 44036.5(b)	Unapproved Calibration Gases
Health and Safety Code Section 44015	Improper Issuance of a Smog Check Certificate

41. What is average fine pre and post appeal?

The table below describes average fine amounts.

Citation Amounts				
APPEAL STATUS	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**
Pre-Appeal	$802	$1,270	$1,230	$1,285
Post-Appeal	$802	$1,251	$1,216	$1,280

42. Describe the Bureau's use of Franchise Tax Board intercepts to collect outstanding fines.

Effective January 1, 2011, Health and Safety Code Section 44050(d) established unpaid citations as grounds for a civil judgment, enabling BAR to collect unpaid citations through the Franchise Tax Board (FTB) Intercept Program. Of the citations and fines issued since that date, only two (2) in the amounts of $1,500 and $1,000, remain outstanding. BAR intends to pursue collection of these citations through all available means, including referral to the FTB Intercept Program as appropriate. It is important to note that the substantial majority of fines are assessed in the form of citations pursuant to the Smog Check Program. Collection of fines issued pursuant to Smog Check is far more successful than collection of cost recovery ordered as part of an administrative decision (described below) because failure on the part of the Smog Check station or technician to pay these fines may result in suspension or revocation of the applicable license. This added incentive for payment results in the high collection rate of these fines.

Cost Recovery and Restitution

43. Describe the Bureau's efforts to obtain cost recovery. Discuss any changes from the last review.

In December 2012, DCA, on behalf of BAR, entered into an agreement with Cedar Financial Services (Cedar) to perform debt collection services on outstanding amounts due. To date, BAR has forwarded to Cedar approximately $115,000 in delinquent accounts for recovery efforts. Delinquent accounts are only forwarded after BAR staff have exhausted all efforts in an attempt to collect the outstanding amounts and the respondent has either refused or reported an inability to pay the amount due, or BAR has been unable to locate the respondent. Internal BAR collection efforts have resulted in the collection of $1.77 million (Table 11) over the last four years. In addition, BAR has collected approximately $85,000 in previously unpaid costs and has entered into payment arrangements with respondents to recover approximately $850,000 in additional unpaid costs resulting from cases adjudicated several years ago.

44. How many and how much is ordered for revocations, surrenders and probationers? How much do you believe is uncollectable? Explain.

BAR secures orders for cost recovery in approximately 60% of its formal administrative cases. Over the last four fiscal years, this has amounted to nearly $6.1 million in costs ordered repaid to BAR. However, approximately $3.0 million of that amount is due upon reapplication and will only be recovered if the respondent chooses to apply for licensure or registration at a later date (Table 11).

45. Are there cases for which the Bureau does not seek cost recovery? Why?

No. BAR always seeks cost recovery. During the settlement of cases, BAR and the respondent come to an agreement as to whether these costs are either due upon the effective date of the decision or due in the future at such time as the respondent applies for any BAR issued license or registration.

46. Describe the Bureau's use of Franchise Tax Board intercepts to collect cost recovery.

Prior to sending accounts to the FTB Intercept Program, BAR's policy is to exhaust all reasonable collection efforts, up to and including sending three notices of collection to the respondent. Upon exhaustion of all reasonable efforts, BAR will submit, through DCA, an FTB Intercept request. To date, BAR has forwarded the information of six debtors owing a total of $92,181.11 to FTB for interception.

Table 11. BAR Administrative Cost Recovery

	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13
Total Cost of Investigation	$5,340,490	$5,296,535	$6,114,746	$4,317,405
Total Cost of Adjudication and Hearings	$2,080,482	$2,006,980	$2,889,885	$2,085,549
Total Enforcement Expenditures	$7,420,972	$7,303,515	$9,004,631	$6,402,954
Potential Cases for Recovery *	151	268	261	204
Cases Recovery Ordered	126	126	157	133
Amount of Cost Recovery Ordered Upon Re-application	$882,595	$768,290	$751,796	$598,219
Amount of Cost Recovery Ordered (not upon reapplication)	$659,568	$841,792	$813,478	$671,961
Total Costs Ordered	$1,542,163	$1,610,082	$1,565,274	$1,270,180
Amount Collected	$865,391	$246,937	$285,701	$368,364

* *Potential Cases for Recovery* are those cases in which disciplinary action has been taken based on violation of the License Practice Act.

47. Describe the Bureau's efforts to obtain restitution for individual consumers, any formal or informal bureau restitution policy, and the types of restitution that the bureau attempts to collect, i.e., monetary, services, etc. Describe the situation in which the bureau may seek restitution from the licensee to a harmed consumer.

As part of its normal complaint mediation business, BAR negotiates reimbursement to consumers to compensate for improper, illegal, or incompetent business practices on the part of automotive repair facilities. Over the last four fiscal years, BAR has secured $18.32 million in savings, rework, or refunds on behalf of consumers.

Court ordered restitution is often sought by local District Attorneys as part of a civil or criminal filing. Since this process is outside of BAR's regular administrative jurisdiction, and restitution collected by courts is not disclosed to BAR, the Court Order Restitution data listed in Table 12 is incomplete.

Table 12. Restitution (Consumer)

MEDIATED RESTITUTION DATA	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13
Refunded to Consumers	$2,140,029	$2,276,469	$2,343,839	$2,427,910
Rework of Vehicle Repairs	$1,244,892	$1,428,752	$1,273,702	$1,205,217
Adjustments to Final Bill	$880,355	$936,183	$826,299	$770,315
Total Savings to Consumers	$4,313,666	$5,156,851	$4,443,839	$4,403,442
COURT ORDER RESTITUTION DATA	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**
Amount Ordered	$48,391	$22,470	$23,093	$33,906
Amount Collected	N/A	N/A	N/A	N/A

Section 6 – Public Information Policies

48. How does the Bureau use the Internet to keep the public informed of Bureau activities? Does the Bureau post Bureau meeting materials online? When are they posted? How long do they remain on the website? When are draft meeting minutes posted online? When does the Bureau post final meeting minutes? How long do meeting minutes remain available online?

BAR utilizes its public Web site to disseminate program specific and general information to consumers, licensees and interested parties. Information provided for consumers includes Web-based services to find Smog Check inspection and repair stations and to verify the status of licenses, Smog Check and vehicle maintenance assistance, and dispute resolution and complaint reporting materials. Web tools provided to technicians, adjustors, and stations include information on licensing, training, and program updates.

BAR posts announcements for upcoming biannual BAR Advisory Group and Educational Advisory Committee meetings on its public Web site approximately 30 days in advance of a meeting.

49. Does the bureau webcast its meetings? What is the Bureau's plan to webcast future Bureau and committee meetings?

BAR Webcasts committee meetings, workshops and regulatory hearings at DCA and at other hosting facilities that have Webcasting capabilities. BAR posts these Webcasts on its public Web site for public viewing and plans to continue doing so.

50. Does the bureau establish an annual meeting calendar, and post it on the bureau's web site?

BAR is not statutorily required to conduct committee meetings; however, its two voluntary advisory groups, the BAG and the Educational Advisory Committee, hold meetings on a periodic basis to provide a forum for input from industry experts and other interested parties on BAR's programs. Schedules and announcements for upcoming committee meetings, workshops and regulatory hearings are posted on BAR's public Web site approximately 30 days in advance of these events. Notices for workshops and regulatory hearings are also sent to interested parties by U.S. mail and e-mail.

51. Is the bureau's complaint disclosure policy consistent with DCA's *Recommended Minimum Standards for Consumer Complaint Disclosure*? Does the bureau post accusations and disciplinary actions consistent with DCA's *Web Site Posting of Accusations and Disciplinary Actions* (May 21, 2010)?

BAR's complaint disclosure policy is consistent with DCA's *Recommended Minimum Standards for Consumer Complaint Disclosure*. Accusations and disciplinary actions are posted on BAR's public Web page and in its biennial newsletter.

52. What information does the bureau provide to the public regarding its licensees (i.e., education completed, awards, certificates, certification, specialty areas, disciplinary action, etc.)?

BAR provides a variety of information related to its licensees through its public Web site and other publications. This information includes, but is not limited to, station or registrant location, license type or specialty areas, job performance rankings known as *STAR* scores, and disciplinary actions.

53. What methods are used by the bureau to provide consumer outreach and education?

BAR uses various approaches to provide outreach and educational information to consumers. The Web site is the most comprehensive source of information on BAR programs. BAR's Web site includes printable brochures in both English and Spanish, fact sheets and various Web services to assist consumers in filing complaints, and locating a station or verifying the status of a license. Additional methods of consumer outreach are provided by DMV (e.g. registration renewal notices, posters and brochures), the DCA Consumer Information Center, letters to community based organizations, and local news stories.

Section 7 – Online Practice Issues

54. Discuss the prevalence of online practice and whether there are issues with unlicensed activity. How does the bureau regulate online practice? Does the bureau have any plans to regulate Internet business practices or believe there is a need to do so?

On-line advertisement of auto repair by unlicensed individuals/facilities is a recurring problem. BAR staff frequently reviews online bulletin boards and other such sites to identify potential unlicensed individuals. It is a practice of BAR Enforcement staff to attempt to engage unlicensed individuals advertising on-line in an in-person repair transaction, at which point BAR issues a citation and order of abatement or monetary fine.

BAR began issuing citations for unlicensed activity in November of 2011, pursuant to California Code of Regulations Section 3394.40, which became operative October 27, 2011.

BAR is exploring regulations requiring advertisers of automotive repair services to publish their registration number in the advertisement, which will further enhance BAR's ability to identify those who are engaged in unlicensed activity.

Section 8 – Workforce Development and Job Creation

55. What actions has the bureau taken in terms of workforce development?

As part of normal business, BAR evaluates its licensing programs and takes action to ensure the programs coincide with legitimate marketplace trends and the best practices of the industry. In 2012, BAR restructured its Smog Check licensing programs, which resulted in more licensing options for stations and more paths to licensure for individuals. The new licensing options provide viable paths to licensure for individuals already working in the automotive repair industry, as well as for individuals in school with a desire to obtain employment in the automotive repair industry. These paths take into consideration the various experience and skill levels of prospective licensees and include knowledge and skill development training provided by BAR-certified training institutions. Additionally, returning military personnel can meet licensure requirements using applicable training and experience gained during military service.

56. Describe any assessment the bureau has conducted on the impact of licensing delays.

BAR does not experience substantial delays in licensing, and therefore no studies have been conducted.

57. Describe the bureau's efforts to work with schools to inform potential licensees of the licensing requirements and licensing process.

BAR collaborates with public and private training institutions and various organizations to ensure the requirements for BAR licensure are communicated to prospective licensees. These efforts include BAR certification of both private and public training institutions to provide training related to BAR's licensing programs. BAR also works with various educational and industry groups by way of participation in conferences and workshops throughout California. These include the California Automotive Teachers Association, Automotive Service Councils of California, California community colleges and high schools, private educational institutions, California Department of Corrections and Rehabilitation, and others.

In 2012, BAR participated in more than 40 workshops to provide information about changes in licensing requirements, Smog Check equipment requirements (On-board Diagnostic Inspection System) and the Smog Check station, inspector, and technician performance evaluation program known as *STAR*.

58. Provide any workforce development data collected by the bureau, such as:

a. Workforce shortages

BAR monitors several industry and marketplace metrics including technician salary, inspection costs, Web bureaus and forums, etc. BAR also conducts meetings with the industry and the public to monitor issues such as this one. Current data and industry do not indicate that there are any workforce shortages at this time.

b. Successful training programs

Effective August 1, 2012, BAR separated the Smog Check Technician license into two license types: Smog Check Inspector and Smog Check Repair Technician. This flexible licensing structure aligns qualifications required for inspectors and technicians to specific services for which they are licensed to provide. New training programs and course work for the two licenses were developed by BAR certified schools using standards defined by BAR. As an aid to schools, BAR developed a comprehensive training program, The California Smog Check Program series, which is a Web-based interactive program that consists of nine modules that cover the fundamentals of the Smog Check Program and inspection procedures. Since the license restructure, BAR certified schools have successfully trained 2,900 individuals looking to become licensed to work under the Smog Check Program.

In addition to the above, BAR has asked the Foundation for California Community Colleges (FCCC), BAR's Referee contractor, to develop an Automotive Resource Center Web site. This Web site will provide information about training, training facilities, employment, and hiring to instructors and the automotive industry.

Section 9 – Current Issues

59. What is the status of the Bureau's implementation of the Uniform Standards for Substance Abusing Licensees?

Uniform Standards do not apply to the Bureau, because the Bureau is not a healing arts program.

60. What is the status of the Bureau's implementation of the Consumer Protection Enforcement Initiative (CPEI) regulations?

Because BAR is not a healing arts bureau, the regulatory changes mandated by CPEI do not apply to BAR. However, BAR strives to achieve the performance measures outlined by CPEI, such as the goal to complete all investigations within 540 days. In addition, BAR continues to report to the department on a quarterly basis its success in meeting the applicable enforcement goals of CPEI.

61. Describe how the Bureau is participating in development of BreEZe and any other secondary IT issues affecting the Bureau.

As one of the largest bureaus within DCA, BAR is a major stakeholder in the BreEZe project. BAR realized early on that its investment in the BreEZe project is both necessary and valuable. To that end, BAR has assigned four staff persons who know BAR's business needs to actively participate with the BreEZe project management team. This allows BAR to acquire early knowledge of the BreEZe system and design, which will assist in the training of staff upon deployment of BreEZe.

While BAR is not scheduled for active participation until preparations for release phase three begin, BAR has chosen to be proactive in its efforts to support the project by contributing the aforementioned staff resources. Additionally, BAR holds a seat on the BreEZe Executive Steering Committee, which allows BAR to keep abreast of the project's progress and to identify further opportunities to provide support.

Section 10 – Bureau Action and Response to Prior Sunset Issues

Bureau Actions and Responses to Prior Sunset Issues. Include the following:

1. Background info concerning the issue as it pertains to the Bureau.
2. Short discussion of recommendations made by the Committee/Joint Committee during prior sunset review.
3. What action the Bureau took in response to the recommendation or findings made under prior sunset review.
4. Any recommendations the Bureau has for dealing with the issue, if appropriate.

In 2003, BAR underwent Sunset Review by the (then) Joint Legislative Sunset Review Committee. Several issues were raised with BAR's administrative structure and enforcement practices. As a result, the Legislature enacted SB 1542 (Figueroa, Chapter 572, Statutes of 2004).

SB 1542 required the Director of Consumer Affairs (Director) to appoint a BAR Administration and Enforcement Monitor (Monitor) by January 3, 2005, to *evaluate the bureau's disciplinary system and procedures, with specific concentration on improving the overall efficiency and assuring the fairness of the enforcement program, and the need for administrative structural changes* (Business and Professions Code Section 9882.6(c)(1)). The Monitor was required to submit an initial written report of findings and conclusion no later than July 1, 2005, and every six months thereafter until the issuance of a final report by December 31, 2006.

The Director selected David Howe of STRATEGICA, a company based in Washington State, as the Bureau's Administration and Enforcement Monitor.

In October 2005, the Monitor issued its 53-page (*Draft 10/18/05*) *Initial Report: Bureau of Automotive Repair Enforcement Monitor* to the Joint Committee on Bureaus Commissions and Consumer Protection. The initial report identified a number of issues and recommendations related to BAR's enforcement program. Following the initial report, a one-year report was issued December 20, 2005, and a two-year report was issued on June 9, 2006. The final report, *2006 Final Report: Bureau of Automotive Repair Enforcement Monitor*, dated December 15, 2006, was approved for distribution on April 2, 2007.

The final report provided an update regarding the Enforcement Monitor's recommendations from the initial report and the two-year report. A total of 12 recommendations were made initially, but two were dropped (Recommendations 5 and 6). As noted below, several were completed or are pending, several required statutory changes, and one (technical review of software products on request) was considered problematic as noted below.

Items completed or pending:

- BAR amended its office conference reports to include an acknowledgement at the end of the report regarding the attendee's understanding of what was discussed and the purposes of the conference. [Recommendation 2]
- BAR implemented recommendations from the Auto Body Repair Inspection Pilot Program Report of September 2003 to the Legislature by reinstating the program in 2006 and establishing a toll-free phone number for consumers to request no-cost inspections of collision repairs by BAR field representatives. [Recommendation 7]
- BAR has been working with industry on updating the disciplinary guidelines regulation and establishing brake inspection procedures. [Recommendations 10 and 12]
- BAR should implement annual or semi-annual technical conferences for shop management software providers and offer technical reviews of software products on request. A potential problem with implementing this recommendation is the perception that the software products primarily dealing with diagnosis and repairs that may differ between providers would be identified as BAR Approved and become an issue in a disciplinary action. [Recommendation 9]

Items requiring legislative change in order to implement:

- Exclusion of the non-adopt provision from the Act. [Recommendation 1]
- Amend Business and Professions Code Section 125.3 to also allow a licensee to seek reimbursement of administrative costs from the state if the state is not able to prove allegations in an administrative hearing. [Recommendation 3]
- DCA should enhance the guidelines and authority of the ombudsman. [Recommendation 4]
- Establish a system of required testing and licensing for service writers covering basic knowledge and application of the Act and sound business practices. Provide training on tested material on a voluntary basis through classroom, on-site or self-directed methods. In addition, at least one beneficial owner of an ARD should be licensed. [Recommendation 8]
- Amend the Act to include limitations for filings in Business and Professions Code Section 9884. [Recommendation 11]

Since the issuance of the Enforcement Monitor's recommendations, BAR underwent a reorganization of its enforcement processes and internal structure in 2008, resolving many of the issues addressed by the enforcement monitor. As a result of the reorganization, all enforcement related cases go through the same review and evaluation process and all office conferences and other enforcement methods have been standardized.

Section 11 – New Issues

This is the opportunity for the Bureau to inform the Committee of solutions to issues identified by the Bureau and by the Committee. Provide a short discussion of each of the outstanding issues, and the Bureau's recommendation for action that could be taken by the bureau, by DCA or by the Legislature to resolve these issues (i.e., legislative changes, policy direction, budget changes) for each of the following:

1. Issues that were raised under prior Sunset Review that have not been addressed.

Any issues raised under the prior Sunset Review and by the Enforcement Monitor that have not yet been addressed are due to the need for legislative changes, as detailed in Section 10. When any statutory change is made, BAR will pursue the necessary steps, regulatory and administrative, to incorporate the change(s). It should be noted that the majority of the recommended legislative changes pertain to statutory provisions that deal with enforcement of all regulated industries within the Department of Consumer Affairs, rather than just those within the statutory authority of BAR.

2. New issues that are identified by the bureau in this report.

There are no new issues identified in this report.

3. New issues not previously discussed in this report.

Some ancillary services now fall within the definition requiring registration as an ARD. For example, in some cases, the exempt services of replacing spark plugs, batteries, and fan belts now require more specialized repair skills to remove automotive systems, engine components, shrouds or other electrical equipment. The latter repair skills require ARD registration.

Another example of repairs exempt from registration under the Automotive Repair Act is tire services. Many modern vehicles are equipped with tire pressure monitoring systems that may require the technician to update the vehicle's on-board diagnostic system when serviced. In addition, the definition of *repair of motor vehicles* may need to be updated by regulation to clarify what constitutes maintenance and repairs of motor vehicles, given changes to automotive technology over time.

4. New issues raised by the Committee.

BAR is unaware of any new issues raised by the Committee.

Section 12 – Attachments

Please provide the following attachments:

A. Bureau's administrative manual:

- Bureau of Automotive Repair Strategic Plan 2013 – 2017 (Attachment A)
- Bureau of Automotive Repair Policy and Procedures (Attachment O)

B. Current organizational chart showing relationship of committees to the Bureau and membership of each committee (cf., Section 1, Question 1):

- Bureau of Automotive Repair Committee Organizational Chart (Attachment N)

C. Major studies, if any (cf., Section 1, Question 4):

- Evaluation of the California Smog Check Program Using Random Roadside Data (Attachment D)
- Comparative Analysis of Current Training and Proposed Training Initiatives for Smog Check Technicians (Attachment E)
- Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California (Attachment F)
- Evaluation of Remote Sensing for Improving California's Smog Check Program (Attachment G)
- 2006 Final Report, Bureau of Automotive Repair, Enforcement Monitor (Attachment H)
- April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance Smog Check Program (Attachment I)

D. Year-end organization charts for last four fiscal years. Each chart should include number of staff by classifications assigned to each major program area (licensing, enforcement, administration, etc.) (cf., Section 3, Question 15):

- Bureau of Automotive Repair Organizational Charts (Attachment L, M and N)

E. Other attachments:

- Bureau of Automotive Repair Impacting Legislation 2003 – 2013 (Attachment B)
- Bureau of Automotive Repair Regulatory Actions 2003 – 2012 (Attachment C)
- Performance Measures (Attachment J)
- Schedule of Workload Revenue (Attachment K)

Attachment A

Bureau of Automotive Repair
Strategic Plan 2013 – 2017

Attachment A

Department of Consumer Affairs

Bureau of Automotive Repair

Strategic Plan 2013–2017

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Message from the Chief

It is with pleasure that I present the Bureau of Automotive Repair's 2013–2017 Strategic Plan. To fulfill our mission with determination and efficiency, we must follow a usable plan that emphasizes a long-range view and realistic goals to attain meaningful improvements to our programs and the services we provide. That includes being aware of all available resources and opportunities that will enable us to adjust to the demands of an ever-changing industry and environment.

Some areas in California continue to be some of the most polluted in the nation. To assist with meeting California's air quality challenges, we must have aggressive goals and implement plans that will minimize unethical business practices and provide significant environmental benefits to our state. With that in mind, we continue to increase our efforts to inform and educate the public and our licensees on the importance of the effective operation of the programs regulated by the Bureau. Utilizing complex equipment and new technology, we have advanced California's Smog Check Program to a level that is state of the art.

While demonstrating some outstanding achievements in the past, this Strategic Plan allows us to re-examine our current challenges with the same inspiration that lead to innovative advances in our Smog Check Program. With these successes and challenges, we will continue into the future as the nation's leader in the vehicle emissions testing industry and as an advocate for the health and protection of the people of California and the nation.

As a key advocate of consumer health and protection, I present this Strategic Plan to BAR employees, consumers, licensees, and interested parties as my pledge to continue to improve and develop the services that the Bureau provides in this state. This plan is our challenge over the next four years to reach goals and objectives that will result in a level and quality of service our consumers and licensees deserve.

John Wallauch
Chief, Bureau of Automotive Repair

Department of Consumer Affairs

Bureau of Automotive Repair

Strategic Plan 2013–2017

Our Mission

The Bureau of Automotive Repair (BAR) protects the health and interests of California consumers by administering an effective vehicle emissions reduction program and ensuring quality automotive repair services from its licensees.

Our Vision

The BAR will be acknowledged as a world leader in protecting and promoting the interests of consumers and in developing innovative and cost-effective approaches to reducing vehicular emissions through the Smog Check Program.

Our Values

As a government agency dedicated to protecting California consumers and the environment, the BAR values:

Accountability – We are accountable to the people of California and stakeholders and encourage communication from all individuals on the programs we regulate.

Integrity – We communicate with truthfulness and make ethical decisions consistent with BAR's mandates and mission without consideration of self-interest.

Employees – We value our employees and provide them with superior service and support.

Efficiency – We strive to deliver high-quality services to all, both inside and outside of the organization, with efficient use of all available resources.

Innovation – We are progressive and initiate new ideas and concepts to improve the automotive repair industry and deliver quality services to the public.

Goals and Objectives

The Bureau of Automotive (BAR) has adopted the following strategic goals for 2013-2017. Through ongoing planning and monitoring, these goals will be re-evaluated and adjusted as necessary to meet business needs.

GOAL ONE

BAR communication efforts will inform, educate, and empower.

1.1 Accelerate retirement of high-polluting vehicles through targeted program solicitation.

1.2 Provide online Consumer Assistance Program (CAP) application services for repair assistance and vehicle retirement.

1.3 Develop educational materials on consumer rights and industry responsibilities.

1.4 Create greater awareness of the STAR, auto body inspection, and other BAR programs.

1.5 Overhaul our public Web site to be more user-friendly for both consumers and industry and review necessity and currency of information displayed about BAR programs.

GOAL TWO

BAR enforcement will continue to protect consumers from illegal and unethical practices.

2.1 Develop a certification program for total loss salvage vehicle repairs.

2.2 Create an electronic system for transmitting lamp and brake certificates to the Department of Motor Vehicles (DMV).

2.3 Expand the use of Smog Check Program data to effectively target enforcement.

2.4 Partner with law enforcement and other agencies to identify vehicles with tampered emissions control systems, as commonly found in street racing.

2.5 Work with DMV and the Referee to identify and take action against counterfeit Vehicle Identification Numbers.

2.6 Identify and take action against persons involved in selling and purchasing fraudulent smog certificates.

2.7 Target false advertising and the selling of services that provide little or no benefit to consumers.

2.8 Identify repair dealers operating without a valid registration and bring them into compliance with the Automotive Repair Act.

GOAL THREE

BAR will continue to implement innovative strategies for achieving the emissions reduction goals of the Smog Check Program.

3.1 Introduce an advanced inspection program for model-year 2000 and newer vehicles.

3.2 Evaluate and update the STAR Program to improve the quality of inspections.

3.3 Continue to collect roadside emissions data and streamline auditing procedures for program evaluation purposes.

3.4 Restructure the repair assistance and vehicle retirement programs to further improve utilization of available resources.

3.5 Dedicate resources to the continuous auditing of vehicle emissions inspection equipment.

GOAL FOUR

BAR will continue to license individuals and register businesses in a timely and efficient manner.

4.1 Transition the licensing and enforcement databases into the Department of Consumer Affairs' (DCA) new consolidated BreEZe system.

4.2 Integrate an electronic imaging process with BreEZe.

4.3 Incorporate an online licensing application and payment process into BreEZe.

GOAL FIVE

BAR will increase organizational productivity to enhance customer service.

5.1 Partner with DCA and the California Department of Human Resources to improve training, development, recruitment, and retention of employees.

5.2 Document operational procedures to preserve institutional knowledge due to retirement and other organizational separations.

5.3 Recognize superior job performance resulting in exceptional contributions to BAR's mission.

5.4 Automate and update internal information technology systems and applications to increase staff productivity.

Accomplishments for 2008–2012

Improved California air quality by assisting motorists in the repair and retirement of vehicles.

The Consumer Assistance Program (CAP) assisted motorists in the repair and retirement of 300,000 vehicles, removing an estimated 50,000 tons of vehicle emissions from California's air.

Utilized modern vehicle technology to identify fraudulent smog testing practices.

The Bureau of Automotive Repair (BAR) developed procedures for the investigation and prosecution of Smog Check technicians and facilities fraudulently using data from the onboard computer system of one vehicle to certify a noncompliant vehicle ("clean-plugging").

Developed and implemented the Education First Program.

This program educates facilities undergoing initial registration as an Automotive Repair Dealer on the Automotive Repair Act and related regulations, the expectations of an Automotive Repair Dealer, BAR programs and policies, and other information necessary to enable the repair facility to maintain compliance with the Automotive Repair Act.

Developed and implemented new methods of combatting unlicensed activity.

In 2011, BAR implemented regulations to authorize administrative citations to be issued in conjunction with Orders of Abatement and monetary fines, which has proven especially effective in addressing unlicensed activity by automotive repair dealers.

Reduced time involved in processing enforcement cases and consumer complaints.

By evaluating complaint intake processes, BAR implemented measures to expedite transmittal of consumer complaints to BAR Field Offices. BAR collaborated with prosecuting agencies to identify areas for improved efficiency and implemented measures to reduce case-processing timeframes.

Enhanced probation monitoring efforts and increased cost-recovery collections.

As part of DCA's Consumer Protection Enforcement Initiative, BAR implemented a probation monitoring and reporting system for compliance with all disciplinary orders containing probation and cost-recovery provisions.

Completed occupational analysis of licensed Smog Check technicians.

In 2009, BAR hired an outside consultant to perform a job analysis for the Smog Check technician license. This study was conducted to ensure the existing occupational analysis was still applicable following several legislative and regulatory changes. Additionally, the analysis confirmed and adjusted license examination weights provided in a 2006 study.

Restructured the Licensing Program to provide several viable licensure paths for Smog Check shops and technicians.

In 2009, an independent consultant hired by BAR determined that license and training programs needed updating. In response, BAR adopted regulations to create licensing options for stations and technicians, which correlate better to the best practices of the automotive repair industry and the knowledge, skills, and abilities involved in this profession. The new licensing program provides multiple paths to licensure for both stations and technicians, as opposed to the old "one-size-fits-all" approach.

Initiated the STAR Program to improve the overall effectiveness of the Smog Check Program.

In December 2011, BAR introduced the first phase of the STAR Program, a legislatively (AB 2289 in 2010) mandated initiative to incentivize higher quality Smog Check inspections. The program requires vehicles most likely to fail their next Smog Check to have their inspections performed at stations meeting specific performance criteria. The program was fully implemented on January 1, 2013. For the first time, Smog Check stations and technicians are evaluated on a publicly accessible Web site that doubles as a management information system for station owners. To develop this program, BAR adopted regulations on the performance measures and other program features with input from the Smog Check industry received at more than 30 statewide workshops. More than 2,500 stations are currently certified under the STAR Program. Early signs suggest that the new program is creating a significant and positive paradigm shift within the industry, resulting in more accurate Smog Check inspections statewide.

Established on-the-job training for students through the Referee Inspection Program.

Working with the Foundation for California Community Colleges (FCCC), BAR provides services for vehicles with unique test requirements that cannot be performed at a licensed Smog Check station. Referee inspection facilities are located at community colleges, which presents a natural opportunity to provide students actual work experience while attending school. Students participating in this program now leave school with automotive knowledge and actual work experience in support of their licensure and employment.

Implemented an inspection program for diesel-powered vehicles.

In partnership with the California Air Resources Board and the Department of Motor Vehicles, BAR completed the implementation of AB 1488 (Mendoza, 2007) to add model-year 1998 and newer diesel-powered vehicles into the Smog Check Program. The inspection program encompasses 500,000 diesel vehicles.

Implemented a visible smoke test for gasoline-powered vehicles.

Following enactment of AB 1870 (Lieber, 2006), BAR incorporated a Visible Smoke Test into the Smog Check Program. This test identifies and requires repairs of vehicles that are emitting excessive plumes of smoke from their tailpipe and/or engine crankcase. The new test helps reduce airborne particulate matter, a cancer-causing carcinogen, emitted by vehicles with excessive exhaust emissions.

Reduced license application processing time.

BAR reduced the amount of time to process an application from six weeks to less than two weeks by streamlining business processes.

Implemented an automated processing system for consumer assistance.

In partnership with its central database contractor, BAR created an automated system for processing and monitoring the status of vehicle retirement and repair assistance applications, tracking disbursements, and issuing reports under the CAP.

Attachment B

Bureau of Automotive Repair
Impacting Legislation 2003 – 2013

Bureau of Automotive Repair
Impacting Legislation 2003-2013

Year	Bill Number	Subject(s)	Affected Code(s)	Affected Section(s)
2003	AB 1718	Define "Total loss salvage Vehicle"	Vehicle	544
2003	AB 377	"Whistle-tip" exhaust	Vehicle	27150.3 & 42001
2003	AB 984	Service Contracts	Civil; Insurance	1794.41; 116 & 116.5
2003	SB 364	Sunset Review	Business & Professions	474, 474.1, 474.2, 474.3, &474.4
2003	SB 434	Investigations and Hearings	Government	11180.5, 11181, 11183, 11184, 11185, 11186, 11187, & 11188
2003	SB 551	Directing automobile repairs	Insurance	758.5
2003	SB 708	Consumer Assistance Program financial eligibility	Health & Safety	44062.1
2004	AB 1079	Defines "customer" for the Automotive Repair Act	Business & Professions	9880.1
2004	AB 2104	Smog Check model year exemption expansion	Vehicle; Health & Safety	4000.1; 44011 & 44091.1
2004	AB 2128	Adjusted abatement fee split between HPRRA and VIRF	Health & Safety	44091.1
2004	AB 2683	Repealed 30-year rolling Smog Check exemption	Vehicle; Health & Safety	4000.1 & 4000.2; 44011
2004	AB 2701	Prohibition of heavy-duty motor vehicle that emit excessive smoke	Health & Safety	44011.6
2004	SB 1107	Smog check excepted vehicles & abatement fee	Vehicle; Health & Safety	4000.1; 44011, 44060, 44091, & 44091.1
2004	SB 1233	Registration requirement of vehicles in excess of 10,000 GVWR	Vehicle	4000.6
2004	SB 1542	Sunset Review, Enforcement Monitor, & ARD signage	Business & Professions	9882, 9882.6, & 9884.17
2004	SB 1615	Out-of-state vehicle registration	Vehicle; Health & Safety	4000.1 & 4000.2; 44004
2004	SB 1784	Defines "collector motor vehicle"	Vehicle	259
2005	AB 383	Consumer Assistance Program financial eligibility	Health & Safety	44062.1
2005	SB 1108	Vehicle registration	Vehicle	4000.1
2005	SB 731	Defines "dealer," and dealer responsibility regarding Smog Check	Vehicle; Health & Safety	285; 44015
2006	AB 1870	Visible smoke test & CAP benefit increase up to $1,500 for qualified applicants	Health & Safety	44012.1, 44017, 44021, 44062.1, 44062.3, & 44094
2006	SB 1849	APA amendments and admin actions against ARDs	Health & Safety	44024.5 & 44062.1
2006	SB 1852	Smog Check records & defines "account (HPRRA)" and "high polluter"	Health & Safety	44037 & 44090
2007	AB 118	Smog abatement fee and established the Enhanced Fleet Modernization Program and subaccount	Vehicle; Health & Safety	9250.1, 9261.1, & 9853.6; 44060.5, 44125, 44126, 44270, 44270.3, & 44271
2007	AB 1488	Diesel Smog Check	Health & Safety	44010.5, 44011, & 44012
2008	AB 2241	Temporary Operating Permit fee and fee exception for Consumer Assistance Program applicants	Vehicle	4156 & 9257.5
2008	AB 2272	Redeines "motorcycle"	Vehicle	400
2008	AB 2433	Authority to issue prabtionary registrations and to deny, suspend, and revoke registrations	Business & Professions	9884.21 & 9884.22
2008	AB 619	Specially constructed vehicle amnesty program	Vehicle	4750.1 & 9565
2008	SB 1696	Disclosure of public records	Government	6253.3 & 6253.31
2009	AB 1179	Auto Body Repair Consumer Bill of Rights	Insurance	1874.87
2009	AB 1200	Directing automobile repairs	Insurance	758.5
2009	AB 318	Registration amnesty program fee	Vehicle	4750.1
2009	SB 734	Eligibility of Smog Check certificate transfer for diesels & correction of HPPRA name	Health & Safety	44011 & 44126
2009	SB 821	License issuance; License denial, suspension, and revocation; ARD Signage; & Consumer Assistance Program agreements for services	Health & Safety	44014.2, 44017.3, 44072.1, 44072.2, & 44095
2010	AB 1659	Sunset review	Government	9147.7
2010	AB 2289	Smog Check testing, citation penalties, Smog Check station performance standards	Health & Safety	44001.1, 44010.5, 44012, 44014, 44014.2, 44014.5, 44014.6, 44015, 44024.5, 44036, 44050, 44050.5, 44051, 44051.5, 44052, 44053, 44054, 44055, & 44056
2010	AB 2461	Specially constructed vehicle amnesty program	Vehicle	4750.1 & 9565
2010	AB 519	ARD towing fee signage	Vehicle	22651.07
2010	AB 787	Consumer Assistance Program Repair Assistance only available to low-income applicants	Health & Safety	44062.1 & 44062.3
2010	SB 346	Motor vehicle brake friction materials	Health & Safety	25250.51, 25250.52, 25250.55, & 25250.62
2010	SB 435	Motorcycle exhaust noise	Vehicle	27202.1
2011	SB 869	Airbags	Business & Professions	9884.76
2012	AB 1588	Renewal requirements for military	Business & Professions	114.3
2012	AB 1854	Airbags	Vehicle	27317

Year	Bill Number	Subject(s)	Affected Code(s)	Affected Section(s)
2012	AB 1904	Expedited licensure for military spouses	Business & Professions	115.5
2012	SB 1576	Ignition Interlock Devices	Business & Professions	9807, 9880.2, & 9982.14
2013	AB 8	Alternative fuel and vehicle technologies: funding programs	Health & Safety; Vehicle	44125; 9250.1
2013	SB 359	Vehicles: retirement and replacement	N/A	N/A
2013	SB 459	Vehicle retirement: low-income motor vehicle owners	Health & Safety	44062.3 & 44125

Attachment C

Bureau of Automotive Repair
Regulatory Actions 2003 – 2012

Bureau of Automotive Repair
Regulatory Actions 2003-2012

OAL Reg. Action #	Subject	Sections Affected
2013-0405-02S	Referee Services and Repair Cost Waiver Limit	Adopt: § 3340.4 Amend: §§ 3340.1 and 3340.43
2013-0322-07S	Smog Check Inspection Procedures	Adopt: §§ 3340.17.1, 3340.17.2, Amend: §§ 3340.1, 3340.16, 3340.16.4, 3340.16.5, 3340.17, 3340.18, 3340.42, 3340.42.2, 3340.45, 3394.5
2013-0114-01N	Smog Check Inspectors and Repair Technicians Application	Amend: § 3340.29
2012-0813-02N	CAP Application and STAR Program Modifications	Amend: §§ 3340.15, 3394.6
2012-0611-01SR	AB 2289 Penalties	Adopt: §§ 3394.25, 3394.26, 3394.27
2012-0216-03S	Repair Assistance Co-Payment Modifications	Amend: §§ 3394.3, 3394.4, 3394.6, and 3394.7
2011-1219-03S	Smog Check Licensing Restructure	Amend: §§ 3306, 3340.10, 3340.15, 3340.16.4, 3340.16.5, 3340.17, 3340.22, 3340.22.1, 3340.23, 3340.28 - 3340.31 and 3340.51.1
2011-1122-03S	Vehicle Registration Amnesty Program	Adopt: § 3340.38
2011-0920-06S	STAR Program	Amend: §§ 3340.1, 3340.16, 3340.16.5, 3340.41 and 3392.1 et. seq.
2011-0819-01S	Administrative Citations and Fine for Unlicensed Activity	Adopt: § 3394.40 et. seq.
2010-0721-05E	Enhanced Fleet Modernization Program - Emergency	Adopt: § 3394.7 Amend: §§ 3394.1, 3394.4, 3394.5, 3394.6
2010-0415-07N	Motor Vehicle Inspection Program Definitions	Amend: § 3340.1
2009-1030-02S	Smog Inspection Requirements	Adopt: § 3340.45 Amend: §§ 3340.5, 3340.15, 3340.16, 3340.42
2009-0924-01S	Emission Inspection System Revision	Adopt: § 3340.42.2 Amend: §§ 3340.17, 3340.42
2008-1103-01S	Licensing of Smog Check Technicians	Amend: §§ 3340.28 and 3340.29
2008-0821-04N	License Prefix Standardization	Amend: § 3351.2
08-0821-04N	Increase from 120 to 180 days when consumer may apply for Vehicle Retirement option after expiration of their vehicle's registration.	Amend: § 3394.4
2008-0710-03N	Consumer Assistance Program Application Revisions (CAP/APP (2/08))	Amend: § 3394.6
2008-0710-02S	CAP Vehicle Retirement Option Eligibility Revisions	Amend: § 3394.4
2008-0403-03N	BAR's Principal Office Address	Repeal: § 3300

Bureau of Automotive Repair
Regulatory Actions 2003-2012

OAL Reg. Action #	Subject	Sections Affected
2007-1129-02S	Visible Smoke Test	Adopt: § 3340.43 Amend: § 3340.42
2007-0820-01N	Consumer Assistance Program Application Revisions (CAP/APP (7/07))	Amend: § 3394.6
2007-0619-06S	Low-Pressure Fuel Evaporative System Test & Initial Testing of Test-Only Directed Vehicles at Gold Shield Stations	Amend: §§ 3340.16, 3340.42, 3392.2
2007-0511-02S	Public Access Information; Disclosure of Complaint Information	Amend: § 3303.1
2006-1221-07S	Invoice Requirements, Individual Prices for Parts and Services/Repairs	Amend: § 3356
2006-1208-05S	Lamp and Brake Inspections, Adjustments, Certifications, Stations and Adjusters	Amend: §§ 3305, 3306, 3307, 3308, 3309, 3310, 3315, 3316, 3320, 3321
2006-1002-01N	CAP Application Revisions (08/06)	Amend: § 3394.6
2006-0829-02N	Deletion of All Remaining References to BAR-90 Test Analyzer System (TAS)	Amend: §§ 3303.2, 3340.15, 3340.18, 3340.32, 3340.42 and 3394.5
2006-0718-01S	Consumer Assistance Program; Low-Income Eligibility (225% FPG) and CAP Application Revisions	Amend: §§ 3394.4 and 3394.6
2006-0418-01S	Revision and Cleanup of Smog Check Station Regulation: 1. Requirements for Telephone Line; 2. Reinforcement of Prohibition Against Testing of Test-Only Vehicles at Test-and-Repair Stations	Amend: §§ 3340.1, 3340.16, 3340.16.5, 3340.17 and 3340.41 Repeal: § 3340.16.6
2003-0425-03S	Emissions Inspection Equipment for Non-Enhanced Smog Check Program Areas	Amend: §§ 3303.2, 3340.15, 3340.16, 3340.16.6, 3340.17, 3340.18, 3340.32, 3340.41 and 3340.42
2003-0422-03N	Mandatory Emissions Inspection Standards and Test Procedures; ASM Testing for Heavy-Duty Vehicles; TABLE II	Amend: § 3340.42 TABLE II
2003-0314-08S	Gold Shield/CAP Station Modifications	Amend: §§ 3340.1, 3392.1, 3392.2, 3392.3, 3392.5 and 3392.6 Repeal: § 3392.4
2003-0124-03S	Definitions; "Clean Piping"	Amend: § 3340.1

Attachment D

Evaluation of the California Smog Check Program Using Random Roadside Data

EVALUATION OF THE CALIFORNIA SMOG CHECK PROGRAM USING RANDOM ROADSIDE DATA

Submitted by:

Air Resources Board
and
Department of Consumer Affairs/Bureau of Automotive Repair

February 2010

--FINAL--

2010 Addendum and Evaluation of the California Smog Check Program Using Random Roadside Data

ARB/BAR 2010 Addendum
Prepared and Submitted by:
Air Resources Board (ARB)
and
Department of Consumer Affairs, Bureau of Automotive Repair (BAR)

Evaluation Report
Prepared and Submitted to ARB/BAR by:
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1801 J Street, Sacramento, CA 95811
Sierra Research Report Number: SR09-03-01
Sierra Research Draft Report Date: March 12, 2009

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This report is available for downloading from the Air Resources Board Internet website at
http://www.arb.ca.gov/msprog/smogcheck/smogcheck.htm

ARB/BAR 2010 Addendum to the "Evaluation of the California Smog Check Program Using Random Roadside Data"

This 2010 Addendum finalizes the report, *Evaluation of the California Smog Check Program Using Random Roadside Data*, dated March 12, 2009, prepared by Sierra Research, Inc.

Report Background

On an on-going basis, the Bureau of Automotive Repair (BAR) conducts random roadside audits (smog tests) on vehicles. The results from these inspections are used to evaluate the performance of the Smog Check program in achieving the federal Clear Air Act requirements.

The Air Resources Board (ARB), in cooperation with BAR, hired Sierra Research, Inc. to conduct an independent research and analysis of the Smog Check Program using data collected from roadside inspections conducted in 2003-2006. The study compares roadside inspection results for 1976-95 (pre-OBDII) model year vehicles to the Smog Check inspection results reported by Smog Check stations for these same vehicles.

Key Findings

Key findings from the study include:

- Of the 1976-95 vehicles sampled, 19% of the vehicles initially passed a tailpipe inspection at a licensed Smog Check station, but failed a roadside audit inspection within a year.
- The data also showed that 49% of the vehicles that failed a roadside audit inspection had failed, and then subsequently passed, a tailpipe inspection at a Smog Check station within the past year.

Report Recommendations

The report recommends the following three actions:

- Develop a method of evaluating station performance to identify low performing stations for increased enforcement and to create incentives for high performing stations.
- Perform inspections of vehicles immediately following certification at Smog Check stations.
- Continue using roadside inspections to evaluate the Smog Check Program.

ARB/BAR Review

The report was subject to a comprehensive analysis by ARB and BAR staff for a better understanding of its contents and to confirm the reasonableness of its findings and recommendations. A solution plan was developed to address program changes necessary to achieve the air quality goals prescribed in the State Implementation Plan (SIP). The scope of the study did not require the contractor to evaluate the reasons for the roadside inspection failure rate. However, Sierra concluded in its report that improper testing or falsified Smog Check test results appear to be contributing factors.

BAR has already taken several steps to address the report findings and recommendations:

- Enhanced use of its new centralized database to determine individual station performance and improve the efficiency of enforcement operations against low-performing stations.
- Obtained court-issued Interim Suspension Orders (ISO) and Penal Code 23 orders to immediately suspend stations and technicians from continuing to perform Smog Check inspections where violations, such as "clean-piping," are identified.
- Teamed up with District Attorneys, who file criminal actions in conjunction with some of BAR's license revocation actions, to make the penalty for violating BAR laws and regulations even more significant.
- Expanded its roadside operations statewide and incorporated use of roadside test data to identify stations and technicians for potential enforcement actions.
- Initiated procurement for standardized software to operate upcoming hardware upgrades to the test equipment used by Smog Check stations.

Additional Recommended Program Changes

Statutory changes are also necessary to upgrade the Smog Check program to achieve additional emission reductions.

- Require vehicles that cause most of the pollution to have Smog Checks performed by stations that meet high performance standards.
- Adopt a more stringent fine structure to respond to stations and technicians that perform improper inspections.
- Permit the state to contract with the private sector to manage a franchise-like network of independently owned Smog Check stations.
- Mandate an annual evaluation of the performance of the Smog Check program using data collected from roadside inspections. Also, require the state to have an independent analysis done of the annual evaluation and report on the results.
- Authorize an alternative Smog Check test method and corresponding test equipment for newer vehicles equipped with updated on-board diagnostic systems (OBDII). OBD testing for newer technology vehicles was approved by the federal Environmental Protection Agency (USEPA) as an alternative to tailpipe testing, and is currently operated successfully in vehicle inspection programs nationwide.
- Establish legislative intent language to encourage Community Colleges and other training institutions to develop innovative programs that will respond to industry demand for automotive technicians.

sierra research

Report No. SR09-03-01

Evaluation of the California Smog Check Program Using Random Roadside Data

prepared for:

California Air Resources Board and California Bureau of Automotive Repair

March 12, 2009

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Report No. SR09-03-01

EVALUATION OF THE CALIFORNIA SMOG CHECK PROGRAM USING RANDOM ROADSIDE DATA

prepared for:

California Air Resources Board
and
California Bureau of Automotive Repair

March 12, 2009

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Disclaimer: The statements and conclusions in this report are those of the Contractor and not necessarily those of the California Air Resources Board (ARB) and Bureau of Automotive Repair (BAR). The mention of commercial products, their source, or their use in conjunction with material reported herein is not to be construed as actual or implied endorsement of such products.

EVALUATION OF THE CALIFORNIA SMOG CHECK PROGRAM USING RANDOM ROADSIDE DATA

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1. EXECUTIVE SUMMARY

Under contract to the California Air Resources Board (ARB) and the Bureau of Automotive Repair (BAR), Sierra Research, Inc. (Sierra) analyzed data collected in BAR's Roadside Inspection Program to evaluate the effectiveness of the Smog Check program. Under the Roadside Inspection Program, vehicles are randomly recruited for inspection at checkpoints set up by the California Highway Patrol (CHP) using a stratified sampling protocol giving preference to older, higher emitting vehicles. BAR staff perform a visual inspection of each vehicle and use portable dynamometers and analyzers to measure emissions with the same Acceleration Simulation Mode (ASM) test procedure used in Smog Check stations. The data provide an independent measure of in-use emissions performance of California's fleet subject to the Smog Check program and can be compared to data being reported by Smog Check stations.

One objective of the evaluation was to compare the post-Smog Check performance of older, pre-1996 vehicles to the post-Smog Check performance determined from a previous evaluation of Roadside data collected in 2000-2002. Under the previous evaluation, it was found that:

> *For pre-1996 model year vehicles that fail their initial Smog Check inspection and receive a passing score on a re-test, 40% were failing again on the roadside within a year of the passing test.*

It should be noted that the 40% failure rate referenced above applies to the exhaust emissions standards and does not account for visual or functional inspection failures present in vehicles that passed the tailpipe standards. Based on Roadside data collected between February 2003 and April 2006, the percent of pre-1996 vehicles failing the emissions test at the roadside within one year of passing a re-test at a Smog Check station has increased from 40% to 49%. When visual and functional failures are included, the Roadside failure rate for vehicles that failed the initial inspection during their previous Smog Check increases to 59%.[1] Post-Smog Check deterioration contributes to the failure rate; however, our analysis of available data indicates that many of the vehicles that initially failed during the previous Smog Check cycle either were not actually repaired or were repaired only temporarily. The excess emissions associated with these vehicles are

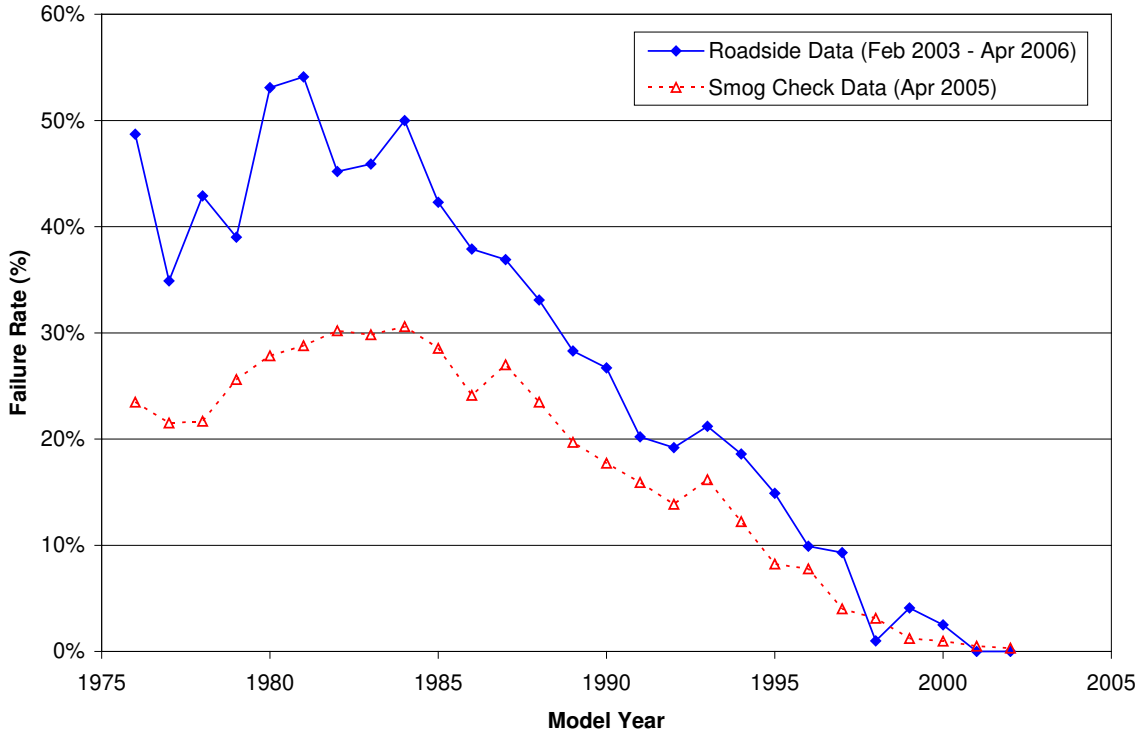
[1] The addition of visual and functional failures would increase the failure rate for vehicles in the 2000-2002 roadside sample also, but this calculation was not performed in the prior study.

estimated at 70 tons per day of hydrocarbons (HC) plus oxides of nitrogen (NOx).[2] Additional details regarding the analysis are set forth below.

Roadside Inspection Program Update

A comparison of model-year-specific tailpipe ASM failure rates from the Roadside data[3] to those observed in the Smog Check program (for April 2005) is shown in Figure 1-1. On average, the failure rate measured in the Roadside Inspection Program is about 1.5 times the failure rate reported on initial tests in the Smog Check program for pre-1996 model year vehicles. This is consistent with previous analyses and may be due in part to pre-inspection maintenance being performed in advance of the official Smog Check test, which is allowed under current law. However, further analysis is required to determine whether other factors are contributing to the difference in failure rates.

Figure 1-1
Roadside vs. Smog Check Program Initial Test ASM Failure Rates



[2] It should be noted that the 70 tons/day increment derived from roadside ASM data is a measure of station performance and the potential for program improvement, but cannot be compared to the I/M benefits in the State Implementation Plan (SIP). Roadside ASM data cannot be directly used in the EMFAC emissions model that is used for California SIPs.

[3] The Roadside data used for this analysis were collected between February 2003 and April 2006, with the bulk of the data collected between April 2005 and April 2006.

As noted above, previous analysis of Roadside data collected in 2000-2002 indicated that 40% of 1974-1995[4] model year Smog Check failures that had been re-tested and certified as passing in the program were failing at the roadside within a year. As shown in Table 1-1, our analysis of the newer (2003-2006) Roadside dataset indicates that 49% of 1976-1995 model year Smog Check failures are failing again within a year of a passing re-test. Thus, the "40%" failure rate has increased to 49% based on the newer Roadside dataset. It should be noted that the vehicles in the newer Roadside dataset are, on average, older than in the previous analysis, and therefore a higher failure rate would be expected. However, a greater concern are vehicles reported as passing the re-test at a Smog Check station that did not actually pass.

Table 1-1
Roadside ASM Tailpipe Failure Rates for Pre-1996 Model Year Vehicles Tested at the Roadside within One Year following a Passing Smog Check (2000-2002 vs. 2003-2006 Roadside Data)

Initial Smog Check Result	2000-2002 Roadside Results	2003-2006 Roadside Results
Fail*	40%	49%
Pass	10%	19%
Overall Roadside Fail Rate	15%	24%

*Note: Although these vehicles failed their initial Smog Check, they eventually were certified as passing the inspection, but subsequently failed a roadside inspection.

Also shown in Table 1-1 is the Roadside failure rate for vehicles that passed their initial inspection within a year prior to the Roadside test. The 2000-2002 Roadside data showed a 10% failure rate for 1974-1995 model year vehicles in this category. The 2003-2006 Roadside data showed a 9% increase in this failure rate (19% overall) for 1976-1995 model year vehicles. (When visual and functional failures are accounted for, the roadside failure rate for vehicles that passed their initial inspection during the prior Smog Check cycle increases to 31%.)

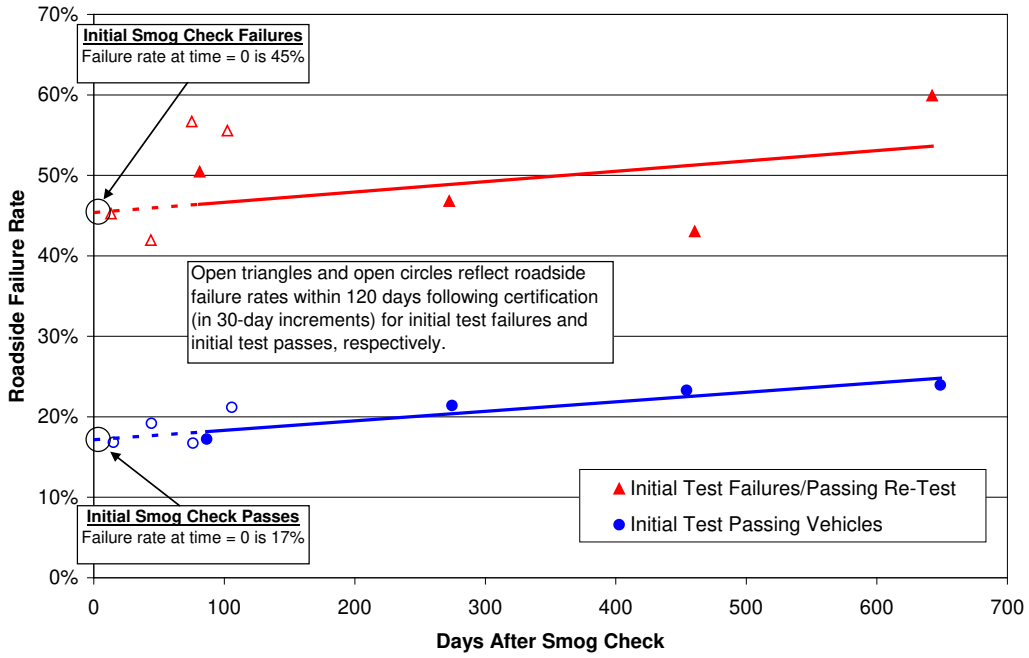
To understand the possible cause of the high ASM tailpipe emission failure rates shown in Table 1-1, roadside failure rates were also analyzed as a function of time following the Smog Check inspection. For this analysis, data were segregated into four time bins: (1) 0-6 months following a Smog Check inspection; (2) 6-12 months following inspection; (3) 12-18 months following inspection; and (4) 18-27 months following inspection. The last time bin was extended beyond two years to allow additional time for motorists that might delay the completion of their biennial inspection cycle.

The results are presented in Figure 1-2 separately for vehicles that were initial test failures and initial test passes during their previous Smog Check cycle. The straight lines fit through the averages of the binned data cross the y-axis ("0" days after Smog Check)

[4] 1974 and 1975 model year vehicles are no longer subject to the Smog Check program as of April 2005.

at a relatively high failure rate of 17% for vehicles that passed their initial Smog Check and 45% for vehicles that initially failed. This indicates that there appears to be a high failure rate at the roadside immediately following a passing Smog Check inspection for both initially passing vehicles and initially failing vehicles. If all of the vehicles actually passed their last test at a Smog Check station, it would be expected that the lines should go through the origin (i.e., zero failures at time = 0 following certification), but they do not.

Figure 1-2
Roadside Tailpipe ASM Failure Rates for 1976-1995 Model Year Vehicles for Initial Smog Check Test Passing and Failing Vehicles Certified at Time = 0



The "hollow" data points shown on Figure 1-2 represents subsets of data from the 0-6 month bin. Each hollow point represents data from four 30-day periods following the official Smog Check inspection: 0-30 days, 31-60 days, 61-90 days, and 91-120 days. The fact that these data points fall along the same lines provides additional evidence that most vehicles observed to be failing at the roadside were failing immediately after having been reported as passing at a Smog Check station.

Further data analysis found that the high failure rates following the Smog Check inspection do not appear to be explained by owner tampering following a passing test. Considering all of the vehicles tested at the roadside test, the tampering rate for vehicles that initially failed during their previous Smog Check cycle was only 9%, which was not significantly different from the 8% tampering rate for vehicles that initially passed their Smog Check.

An analysis was also conducted to determine whether the higher roadside failure rates observed for vehicles that initially failed their last Smog Check might have been due to test-to-test variability. Vehicles that were marginally passing the test would be more likely to fail a subsequent test due to test-to-test variability. However, the average passing test results for vehicles that initially failed were almost identical to the average test results for vehicles that initially passed. In fact, on average, the HC and NOx emissions for both groups of vehicles were only 45% of the emissions standards. Carbon monoxide (CO) emissions were even lower.

Station Performance Analysis

To gain further insight as to why almost half of the vehicles reported as passing Smog Check after initially failing are again failing when tested at the roadside, an analysis was conducted to determine whether the roadside test results of vehicles could be correlated with the performance of Smog Check stations. The analysis used a prototype Station Performance Algorithm developed by BAR in 2005 that ranked stations based on the percentage of vehicles that passed their next Smog Check inspection (accounting for station-to-station differences in model year, mileage, make, and other characteristics of tested vehicles). High-performing stations were considered those that certified vehicles in one inspection that passed at a higher rate in the next Smog Check inspection when compared with similar vehicles. Although development and evaluation of a formal station performance system is not complete, the roadside data analysis indicates that BAR's prototype algorithm appears to be effective in identifying the stations and technicians that ensure vehicles legitimately pass the Smog Check test prior to issuing a certificate of compliance. The analysis indicates that there are significant differences in the percent of vehicles that can be expected to pass a roadside test based on the ranking of the Smog Check station at which the passing test was obtained.

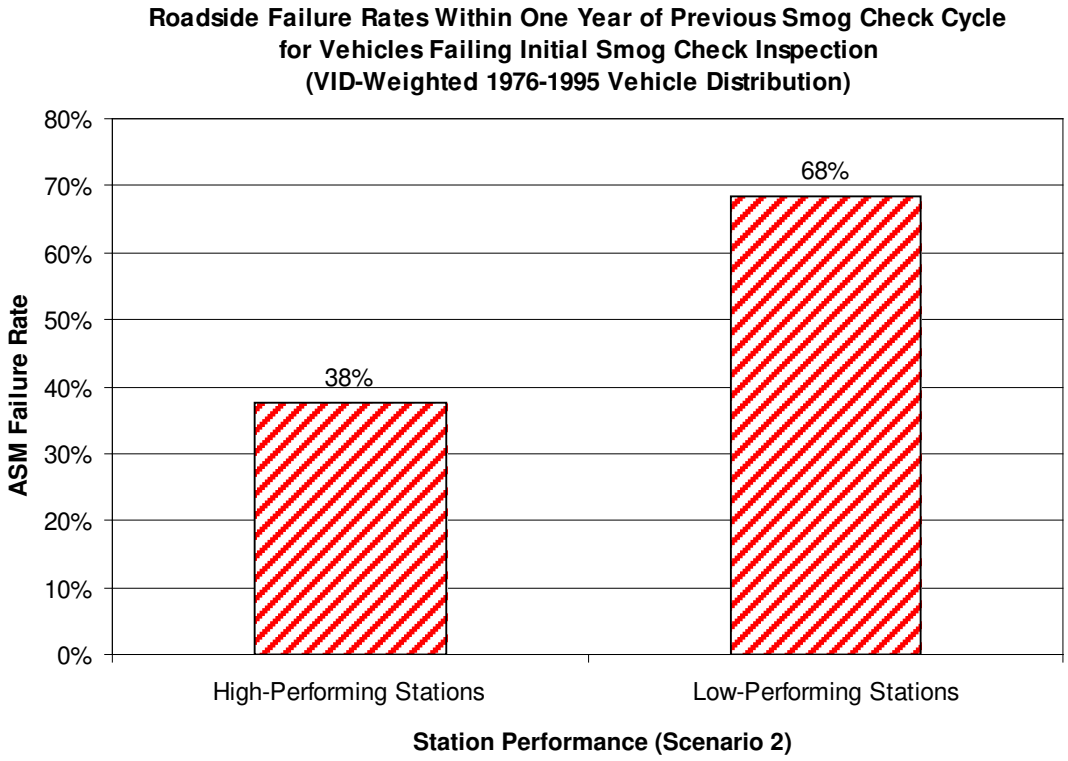
Figure 1-3 shows how the Roadside failure rates compare for stations with different scores using the Station Performance Algorithm. The results shown in the figure are for vehicles that failed the initial test during the previous Smog Check and should have received repairs to pass the test. Using the most stringent criteria (Scenario 2, as described in Section 5 of this report), the failure rate at the roadside was 38% for vehicles last certified by high-performing stations and 68% for the vehicles last certified by low-performing stations.

It should be noted that 79% of the Smog Check stations involved in this analysis (1,493 out of 1,886) were Test-Only stations. Because repairs are not performed at Test-Only stations, and because the high roadside failure rate for vehicles that failed the initial inspection in the previous Smog Check cycle shows up immediately after the re-test and does not appear to be related to owner tampering, Test-Only stations with a low rank sometimes appear to be inappropriately passing vehicles that should have failed.

The impact of station performance on the emission reductions achievable from the Smog Check program was estimated based on the assumption that the level of performance

shown in Figure 1-3 for high performing stations could eventually be achieved for all stations. Based on this assumption, we estimate that there would be an additional 69.5 tons per day of ROG+NOx emissions reductions for 1976-1995 model year vehicles. This is nearly a 30% increase in Smog Check program benefits, which should bring the program close to reaching the target I/M benefits for this model year group of 315.8 tons per day.[5]

Figure 1-3



Additional Analyses

The Roadside results suggest that many of the vehicles initially failing Smog Check are not being repaired at all or are not being properly repaired. Additional analyses were conducted examining failure patterns by vehicle make, improper test type selection, mismatch of vehicle look-up information, and the frequency of aborted, training mode and pretests to determine if these factors could explain the high refail rate. With the exception of the frequency of aborted tests and pretests, no pattern could be found in the other areas that would explain the follow-up failure rate on the roadside.

The analysis did indicate that vehicles failing their subsequent roadside test within one year were more likely to have received an aborted test or a pretest than was the case for

[5] For the reasons noted previously, this estimate cannot be compared directly to the I/M benefits in the State Implementation Plan.

vehicles that passed at the roadside. Based on this analysis, it appears as though some Smog Check stations are attempting to determine whether a vehicle is likely to fail before they conduct the official test and that a vehicle's subsequent failure during a roadside test is somehow related to whether it received a pretest or an aborted test.

One possible explanation as to why vehicles with an aborted test or pretest are more likely to fail when subsequently tested at the roadside is that a technician is attempting to determine whether the official test needs to be altered in some way to generate a passing score. There are ways to falsify test results through the use of techniques such as "clean piping" (measuring the tailpipe emissions of a known clean vehicle instead of the vehicle identified in the Smog Check record), as well as falsifying visual or functional inspection results.

Focus Group Study Results

Five separate focus groups were also used to investigate reasons for the high roadside failure rate of vehicles that initially failed during the previous Smog Check cycle. These focus groups were intended to provide insight into future potential analysis topics. A focus group consisting of BAR personnel suggested several technical differences between the roadside testing and the tests conducted at Smog Check stations that could explain differences in test results (e.g., differences in test conditions, test equipment, and equipment maintenance). However, these suggestions explain only relatively small differences that would not change the results of this analysis.

In addition, BAR personnel, vehicle owners, Smog Check station managers, and technicians who participated in the focus groups all mentioned that the possibility of obtaining an illegal passing certificate through bribery, but it is unknown to what extent this occurs. BAR personnel and Smog Check station personnel also mentioned the failure of inspectors to perform adequate visual and functional checks as contributors to the problem, along with the use of cheap, aftermarket catalysts. (However, our analysis of available repair data does not indicate that the use of aftermarket catalysts is a significant factor.)

The focus groups also revealed that incentives exist that likely reward low performance, as it is more profitable for stations, and more affordable and convenient for motorists, when inspections are done quickly and cheaply, which often leads to improper and incomplete tests. Attachment 1 contains more details about the focus group study.

Recommendations

Based on the analysis described above, improper or falsified Smog Check results appear to be contributing to the 49% tailpipe failure rate at the roadside for vehicles that initially failed during the previous Smog Check cycle. While the existing BAR enforcement program has been successful in identifying some stations that produce falsified or

incorrect test results, it cannot identify Smog Check stations that are willing to falsify a test result only for routine customers. None of the specially prepared vehicles used by BAR are taken to Smog Check stations by routine customers of the station.

To better address the extent to which improper and/or falsified test results may be factors in the Smog Check program, the following additional steps should be considered:

1. Further refine the Station Performance Algorithm and use it to target low-performing stations for increased enforcement and to create incentives for more stations to become high performing. Adding "fingerprint" analysis of OBD inspection results in Smog Check data is one of the approaches that could be included in the Station Performance Algorithm when the next generation of Test Analyzer Systems is deployed. If more detailed OBD results are collected by new analyzers, it should be possible to determine when a Smog Check station is reporting OBD inspection results that are inconsistent with the results that should have been generated for a particular make and model.

2. Perform inspections of vehicles immediately following certification at Smog Check stations. This would facilitate the inspection of vehicles owned by routine customers that may be treated differently than vehicles unknown to the station. The options for accomplishing such inspections include roadside inspections of vehicles leaving Smog Check stations or on-site inspections of vehicles that are preparing to leave a station.

3. Continue the Roadside Inspection Program. Using the results from this analysis as the baseline, continuation of the Roadside Inspection Program will enable the effectiveness of future Smog Check program improvements to be measured. Roadside data should also be used to target low performing stations for additional enforcement.

###

2. INTRODUCTION

Under contract to the California Air Resources Board (ARB) and the Bureau of Automotive Repair (BAR), Sierra Research, Inc. (Sierra) analyzed data collected in BAR's Roadside Inspection Program to evaluate the effectiveness of the Smog Check program. The Roadside Inspection Program has been used to provide ongoing information regarding the emissions and compliance status of vehicles subject to the enhanced Smog Check program. The program measures how effective the Smog Check program has been in providing a fleet of vehicles free from emissions-related defects.

This report summarizes the results of the 2003-2006 Roadside data analysis. It includes an analysis of how the roadside data correlate with Smog Check station performance as estimated using a prototype Station Performance Algorithm. It concludes with recommendations concerning future Smog Check projects and evaluations.

Organization of the Report

Following this introduction, Section 3 of the report provides a description of the Roadside Inspection Program. Section 4 summarizes the results of the roadside data analysis. Section 5 summarizes the Station Performance Algorithm and related analyses. Section 6 contains supplementary analyses of the roadside data. Section 7 contains recommendations for future work. Attachment 1 contains the results of the focus group study conducted by subcontractor Eastern Research Group (ERG).

###

3. BAR'S ROADSIDE INSPECTION PROGRAM

For many years, BAR has been collecting emissions data and visual inspection results through a Roadside Inspection Program conducted with the assistance of the California Highway Patrol. Vehicles are randomly selected using a stratified sampling protocol giving preference to older, higher emitting vehicles. Vehicles are given a Smog Check inspection using portable dynamometers and analytical equipment to measure emissions using full-duration two-mode Acceleration Simulation Mode (ASM) test procedures.

Equipment and Test Procedures

A complete description of the Roadside Inspection Program has been documented previously by BAR[6], and therefore only a brief overview is provided here.

- *Site Selection* – A rigorous random sampling protocol is used to select testing locations from the zip codes included in the enhanced Smog Check areas of the state. Test sites are limited to zip codes with more than 1,000 registered vehicles, and locations are physically limited to four-lane surface streets with a maximum speed limit of 45 mph.

- *Equipment* – The test equipment (Environment System Products' BAR97 EIS) complies with official Smog Check inspection requirements.

- *Vehicle Selection* – In a true random sample of California vehicles, older, higher emitting vehicles would be under-sampled relative to their contribution to fleet-average emissions while newer vehicles would be over-sampled. To ensure representation in proportion to fleet emissions, BAR uses a stratified random sampling procedure to increase the likelihood of older vehicles being proportionally represented.

- *Test Protocol* – Test vehicles are given a standard Smog Check inspection, including a visual, functional, and tailpipe test; however, ignition timing and EGR functional testing is omitted and the fast-pass algorithm, used to reduce test time in standard Smog Check program tests, is bypassed.

[6] "Roadside Inspection Program," Bureau of Automotive Repair, Report No. 2000-02, February 9, 2000. *http://www.epa.gov/otaq/regs/im/roadside.pdf*

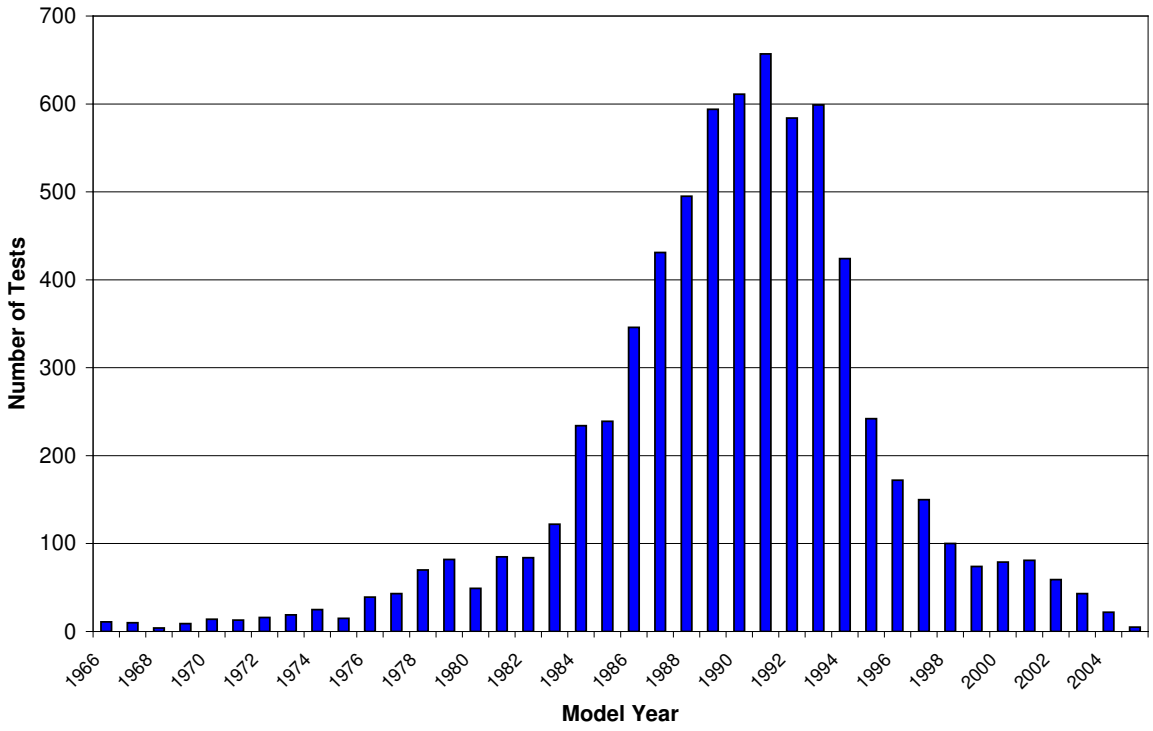
- *Quality Control and Quality Assurance* – Quality Control checks meeting or exceeding standard Smog Check program requirements are made during roadside testing. These checks include calibration of the dynamometer every third day and audit calibration of all gases at least three times a day (immediately prior to inspection of the first vehicle, midway through the shift, and at the end of the shift).

Basic Roadside Population Statistics

The roadside data discussed in this report were collected between February 2003 and April 2006. Figure 3-1 summarizes the Model Year frequency distribution of the roadside sample. As noted above, a stratified random sampling technique is used to select vehicles for the vehicle pullover test program. Newer vehicles are deliberately under-sampled and older vehicles are over-sampled relative to their distribution in the fleet. This policy is reflected in the relatively low number of vehicles less than 10 model years old and disproportionately high number of vehicles more than 25 model years old.

Figure 3-1

Distribution of Tests by Model Year in the Roadside Data Collected Between February 2003 and April 2006



Second-by-second results were retained for each roadside test performed in this program. This allowed the application of a "fast-pass" algorithm to the full duration roadside data to determine the passing or failing result. This was important in order to maintain comparability between the roadside results and Smog Check results recorded in the Vehicle Information Database (VID), which are based on a fast-pass algorithm to control test duration and to determine pass/fail status.

For many of the analyses presented later in this report, results were segregated into model year groups on the basis of similarities in emissions standards and emission control technology. The population of those model year groups in the roadside sample is summarized in Table 3-1. The impact of vehicle-miles-traveled (VMT) by each model year group was accounted for using CARB's EMFAC model whenever estimates of fleetwide effects were made from the data. The 1966-1975 model year vehicles were included in the Roadside sample even though they are not subject to the program to obtain information regarding their contribution to total vehicle emissions. Also shown in Table 3-1 is the population distribution of those groups observed in the VID for calendar year 2005 (representing the 2003 to 2006 roadside sample period). The VID statistics were used to compute weighted averages.

Table 3-1
Model Year Distribution in the Roadside Data Versus the VID

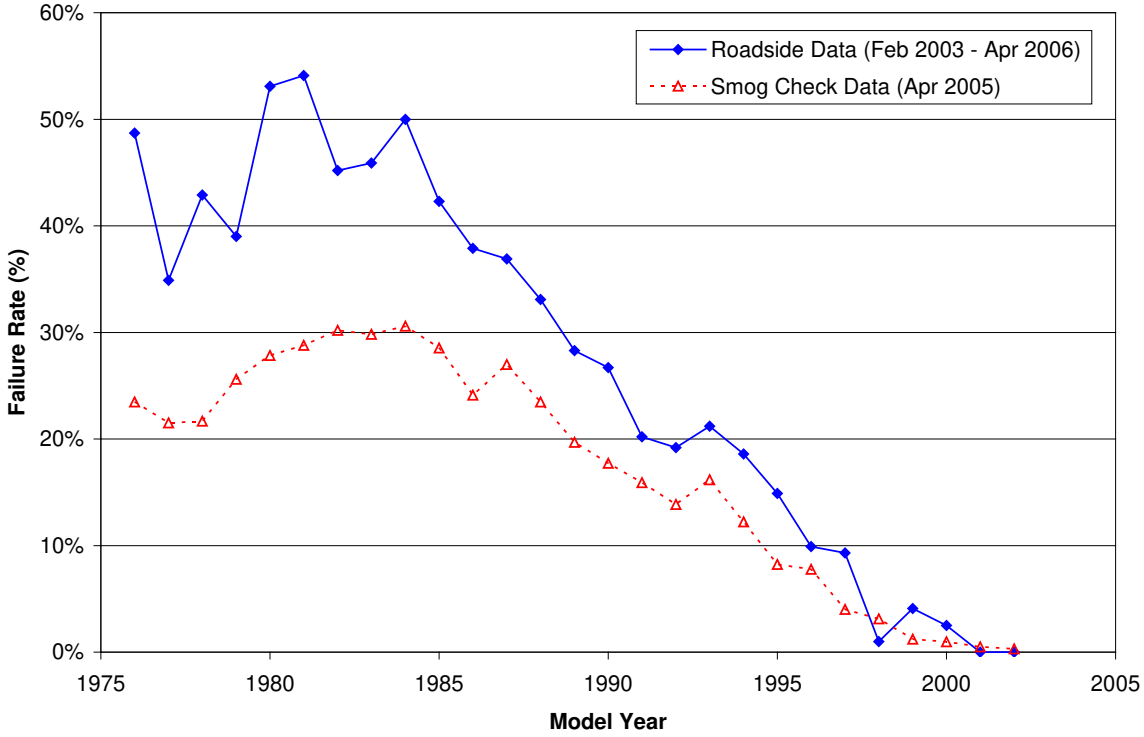
Model Year	Roadside Distribution		VID Distribution
	Number	Percent	
1996+	785	11%	46%
1991-1995	2505	36%	30%
1986-1990	2477	36%	17%
1981-1985	764	11%	4%
1976-1980	283	4%	2%
1966-1975*	136	2%	--
Total	6950	100%	100%

* Rolling 30 model year exemption was eliminated in 2005.

Comparison of Roadside and Smog Check Failure Rates

Figure 3-2 depicts the exhaust emission failure rates by model year observed in the 2003-2006 roadside dataset, with the initial test ASM tailpipe failure rates recorded in the April 2005 Smog Check VID displayed for comparison. The roadside failure rates are generally about 1.5 times the initial test failure rates seen in the Smog Check program for older vehicles.

Figure 3-2
Roadside vs. Smog Check Program Initial Test ASM Failure Rates



A much lower failure rate can be seen in the 1996 and newer vehicles in both the Roadside Inspection and Smog Check Programs. In addition, the actual emissions produced by a properly operating model year 2000 vehicle are much lower than those produced by an equivalent properly operating model year 1980 or older vehicle. The higher base emissions and higher failure rate combine to create much higher total emissions, even when the relative population and vehicle miles traveled (VMT) usage of the two groups are considered. For example, 1980 model year passenger cars that are free of emissions-related defects are only required to meet exhaust emissions standards of 0.39 grams per mile (g/mi) of non-methane hydrocarbons (NMHC) and 1.0 grams per mile NOx. In contrast, the emissions standards that apply to 2000 model year passenger cars are 80% lower: 0.073 g/mi NMHC and 0.2 g/mi NOx.[7]

Roadside and Smog Check Data

Additional processing of the second-by-second emissions data from Roadside Inspection Program was performed to provide a set of test results that could be directly compared to

[7] Individual 2000 model year passenger car models may be certified to meet standards associated with any of four "Low Emission Vehicle" categories. The NMHC and NOx values listed represent the average emissions for all models.

those obtained in the standard Smog Check program which uses a "fast-pass" algorithm to shorten testing time. The appropriate emission cutpoints were applied to the calculated scores to arrive at pass-fail results that would be expected during a standard Smog Check test.

Results from the standard Smog Check program are reported in BAR's VID. VID results from calendar years 2000 through 2006 were included. Each result reported for each vehicle VIN included in the roadside testing was segregated from the VID for additional analysis.

###

4. ANALYSIS OF ROADSIDE AND SMOG CHECK DATA

During an evaluation of the Smog Check program conducted in 2002, results obtained on vehicles in the roadside program indicated that 40% of vehicles repaired after failing the initial test at a Smog Check station were failing a roadside test within one year. The BAR and the ARB staff directed Sierra to update the previous analysis[8] with more recent data and to attempt to determine the cause of the high percentage of vehicles failing at the roadside within one year of having passed a Smog Check.

The 2002 analysis was performed by Sierra under contract to ARB and BAR.[9] The following methodology was used:

- Roadside data collected from January 2000 through October 2002 were merged with earlier VID data to obtain the Smog Check history of vehicles in the roadside sample. The vehicle VIN was used to match results.

- Vehicles that had failed their initial Smog Check inspection (ASM only) and subsequently passed and received a Smog Check certificate within one year prior to the roadside inspection were identified. There were 735 vehicles in this group.

- Roadside ASM failure rates were calculated based on the fast-pass methodology for this sample of vehicles for model years 1974 through 1995.

- The model year specific average roadside failure rates were weighted by the distribution of initial tests observed in the VID (December 2000 through November 2001 data) for 1974[10] through 1995 model year vehicles to arrive at an overall roadside failure rate for this group of vehicles.

- The analysis found that 40.4% of the vehicles that failed their initial Smog Check inspection, then passed and received a certificate at a Smog Check station, were again failing in a roadside test performed within one year.

[8] Refers to the "April 2005 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program" dated September 2005.

[9] "Technical Support Document for Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program April 2004 Draft Report to the Inspection and Maintenance Review Committee -- Part 2," California Air Resources Board, Bureau of Automotive Repair, and Sierra Research, June 2004. *http://www.arb.ca.gov/msprog/smogcheck/jun04/tsd_part2.pdf*

[10] A 30-year rolling exemption was eliminated in 2005, making 1976 and newer vehicles subject to the Smog Check program.

A summary of roadside failure rates for this group of vehicles, by model year group, is provided in Table 4-1. Several additional analyses of the 2000-2002 roadside data were performed, including roadside results for initially passing vehicles, subsequent roadside failure rates by station type, and roadside failure rates within 90 days of Smog Check certification. The conclusion drawn from these additional analyses was that vehicle deterioration does not appear to explain the differences observed between the Smog Check results (i.e., a zero failure rate at the time of certification) and the roadside results.

Table 4-1
Roadside ASM Failure Rates for Initial Test Smog Check Failures
Tested at the Roadside Within One Year After Certification
(Based on January 2000 through October 2002 Roadside Data)

Model Year	Sample Size	Roadside Failure Rate
1974 – 1980	87	39%
1981 – 1985	272	47%
1986 – 1990	327	41%
1991 – 1995	49	36%
VID-Weighted 1974 – 1995	735	40%

Comparison of More Recent Roadside Data to the Previous Analysis

During kickoff meetings with ARB, BAR, Sierra, and other subcontractors (Eastern Research Group and de la Torre Klausmeir Consulting) involved in the 2005 Smog Check Evaluation Program, agreement was reached to repeat the analysis using the larger, more recent 2003-2006 Roadside dataset. Sierra also performed a number of additional analyses. The first such analysis was a direct comparison of the previous roadside "re-fail" rate to that observed in the 2003-2006 Roadside data. These results are summarized in Table 4-2.

Table 4-2
Roadside Failure Rates for Initial Test Smog Check Failures
Tested at the Roadside Within One Year After Certification
(Based on February 2003 through April 2006 Roadside Data)

Model Year	Sample Size	VID Distribution	ASM Failure Rate	Tailpipe (ASM) + Vis/Func Failure Rate
1976 – 1980	29	3.6%	62%	66%
1981 – 1985	103	8.3%	57%	79%
1986 – 1990	258	31.5%	47%	59%
1991 – 1995	186	56.6%	48%	56%
VID-Weighted 1976 – 1995	576	100%	49%	59%

Table 4-2 shows an even higher tailpipe (ASM) re-fail rate of 49% for the newer dataset. As shown in the last column of the table, the failure rate increases to 59% when visual and function failures are included. (As noted previously, the effect of visual and functional failures on the 2000-2002 roadside sample was not computed.) For the second analysis, results were limited to 1976-1995 model year vehicles because the 1974-1975 model year vehicles are no longer subject to testing in the Smog Check program. A higher re-fail rate for the newer roadside data would still be expected because the remaining vehicles are, on average, about four years older than they were during the previous analysis.

Analysis was also done on the performance of initial Smog Check passes during a subsequent roadside test. Table 4-3 presents both roadside ASM failure rates for initial test failures that subsequently passed Smog Check and initial test passes performed within one year prior to the roadside test. Results are presented for both the 2000-2002 roadside data and the 2003-2006 roadside data. The roadside failure rate for passing vehicles was also found to have increased about 9%.[11] Again, the age of the pre-1996 model year population was about four years older so a somewhat higher refail rate was expected.

Table 4-3
Roadside ASM Failure Rates for Pre-1996 Model Year Vehicles Tested at the Roadside Within One Year After a Passing Smog Check (2000-2002 vs. 2003-2006 Roadside Data)

Initial Smog Check Result	2000-2002 Roadside Data	2003-2006 Roadside Data
Fail*	40%	49%
Pass	10%	19%
Overall Fail Rate	15%	24%

*Note: Although these vehicles failed their initial Smog Check, they eventually were certified as passing the inspection prior to failing again at the roadside inspection.

Applying the above percentages to the number of initial tests conducted in 2005, it is estimated, based on the emissions portion of the test, that approximately 380,000 1976-1995 model year vehicles that failed their initial Smog Check inspection and were subsequently certified as passing, are in a failing condition again within a year ("Fail-Fail" vehicles). Similarly, roughly 750,000 1976-1995 model year vehicles that passed their initial Smog Check inspection are in a failing condition within a year ("Pass-Fail" vehicles). Because the Smog Check program has a biennial (2-year) cycle for testing all vehicles subject to the program, nearly double this number of vehicles (i.e., over 2

[11] It should be noted that the 19% failure rate shown in the table is based only on the tailpipe test. When visual and functional failures are included, the failure rate increases to 31%.

million vehicles) may be exceeding their allowable tailpipe emissions within one year of passing their Smog Check.

Estimated Federal Test Procedure-based HC and NOx emission rates (in g/mi) for vehicles in the Roadside dataset are summarized in Table 4-4. The table compares initial Smog Check test results of vehicles to their Roadside test results. Three points can be made with respect to this table:

- Initial Smog Check failures that are certified and subsequently pass on the roadside within one year ("Fail-Pass" vehicles) have emission rates similar to vehicles that initially pass Smog Check and continue to pass on the roadside ("Pass-Pass" vehicles). For example, Table 4-4 shows that the "Fail-Pass" vehicles average 0.70 g/mi HC compared to 0.62 g/mi HC for the "Pass-Pass" vehicles. The Smog Check program appears to be working to properly identify and ensure effective repairs for the "Fail-Pass" vehicles.

- Emission rates for "Fail-Fail" vehicles and "Pass-Fail" vehicles are similar (1.64 vs. 1.55 g/mi HC; 1.55 vs. 1.54 g/mi NOx), but the emission levels are nearly twice what they are for the "Pass-Pass" and "Fail-Pass" vehicles, which means that the Smog Check program is not resulting in the identification and effective repair of these vehicles.

- Because the number of "Pass-Fail" vehicles (750,000) is estimated to be twice as large as the number of "Fail-Fail" vehicles (380,000), the excess emissions from "Pass-Fail" vehicles may be twice that of "Fail-Fail" vehicles.

Table 4-4
Roadside FTP Emission Rates for Pre-1996 Vehicles with a Roadside Test Conducted within One Year After Passing Smog Check

Initial Smog Check Result	Roadside Result	HC (g/mi)	NOx (g/mi)
Fail*	Fail	1.64	1.55
	Pass	0.70	0.92
Pass	Fail	1.55	1.54
	Pass	0.62	0.83

*Note: Although these vehicles failed their initial Smog Check, they eventually were certified as passing the inspection.

Detailed Analysis of More Recent Data

Failures by Pollutant and Test Mode

Detailed analyses were performed using the new 2003-2006 roadside dataset. One analysis was performed to determine if the vehicles failing Smog Check were failing the roadside inspection for the same pollutant and ASM test mode. The results are shown in Table 4-5 for pre-1996 vehicles that were tested on the road within one year following a passing test after initially failing a Smog Check. That table indicates that the "re-fail" rate for individual pollutants and test modes ranges from a low of 58% (mode 1 CO) to a high of 76% (mode 1 NO). When either mode is considered, 74% of the vehicles initially failing for HC at a Smog Check station are again failing for HC at the roadside, 68% of the CO failures at a station are again failing for CO on the roadside, and 83% of the NO failures at a station are again failing for NO at the roadside within a year after passing the Smog Check. While this does not necessarily explain the high failure rate observed on the roadside, the similarity in failure patterns suggests that many vehicles were not actually repaired before they were recorded as passing the Smog Check retest.

Table 4-5
Percentage of Failures for the Same Pollutant/Test Mode for Pre-1996 Vehicles Failing Smog Check and Roadside Within a Year Following Certification

Pollutant	ASM Test Mode	Percentage Failing for Same Pollutant/Test Mode
HC	1	73%
	2	63%
	Either	74%
CO	1	58%
	2	60%
	Either	68%
NO	1	76%
	2	67%
	Either	83%

Failures Due to Deterioration

Vehicle deterioration was investigated by segregating results into the previously described model year groups, and computing weighted averages for four time periods prior to the roadside failure:

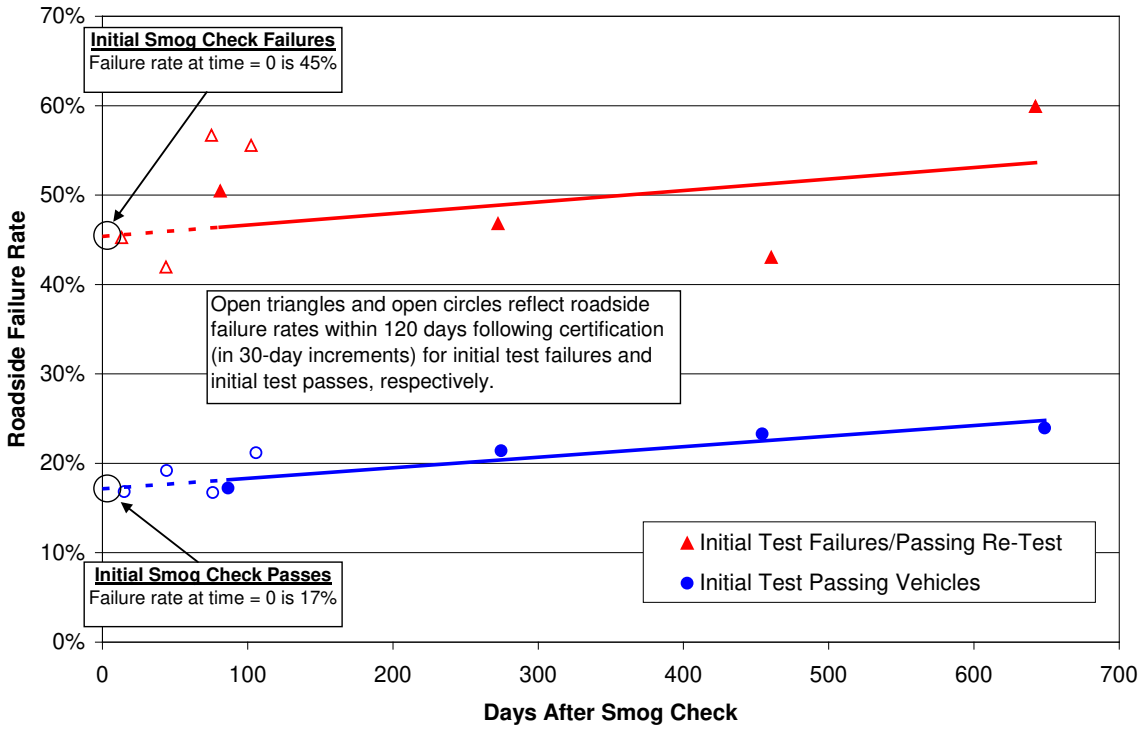
- 0-6 months following Smog Check (288 initial passes, 1,206 initial fails);
- 6-12 months following Smog Check (288 initial passes, 1,121 initial fails);

- 12-18 months following Smog Check (263 initial passes, 967 initial fails); and
- 18-27 months following Smog Check (247 initial passes, 903 initial fails).

The numbers in parentheses indicate the number of vehicles tested at the roadside during each period based on whether they passed or failed their initial inspection during their previous Smog Check. The last time bin was extended beyond two years to allow additional time for motorists that might delay the completion of their two-year biennial inspection cycle.

Within the 0-6 month period, the first 120-days were further divided into 30-day increments to examine the possible rapid deterioration of vehicles after having Smog Check repairs. Overall results are summarized in Figure 4-1.

Figure 4-1
Roadside Tailpipe ASM Failure Rates for 1976-1995 Model Year Vehicles for Initial Smog Check Test Passing and Failing Vehicles Certified at Time = 0



The results are presented in Figure 4-1 separately for initial test failures and initial test passes during the previous Smog Check. The straight lines fit through the averages of the binned data cross the y-axis ("0" days after Smog Check) at a relatively high failure rate of 17% for vehicles that passed their initial Smog Check and 45% for vehicles that initially failed. This indicates that there is a relatively high failure rate at the roadside immediately following a passing Smog Check inspection for both initially passing vehicles and initially failing vehicles. If all of the vehicles actually passed their last test

at a Smog Check station, it would be expected that the lines should go through the origin (i.e., zero failures at time = 0 following certification), but they clearly do not.

In Figure 4-1, roadside results observed during the first 120 days following Smog Check certification validate the hypothesis that rapid deterioration of the vehicle likely did not occur. This is particularly apparent in the larger passing vehicle set where the data points are clustered closely around the linear trend line with a shallow slope. More scatter is observed with the failing vehicle set, which may be a result of the smaller sample size of those vehicles. Neither set of results shows a dramatic increase in roadside failure rates for vehicles in the four months immediately following their Smog Check inspection and only a slight increase in the failure rate over the entire 27-month period.

While the data presented in Figure 4-1 deal only with failure rates, an analysis of the average emission levels shows a similar trend. Figures 4-2, 4-3, and 4-4 show the trend in average HC, CO, and NOx emissions, respectively, estimated from the ASM test results. As shown in the figures, vehicles failing at the roadside within one year of passing Smog Check do not demonstrate a significantly different deterioration rate depending on whether their initial Smog Check test result was a pass or a fail, with the exception of one point in Figure 4-2.

Figure 4-2

Roadside FTP HC Emission Rates for 1976-1995 Model Year Vehicles Versus Time After a Passing Smog Inspection

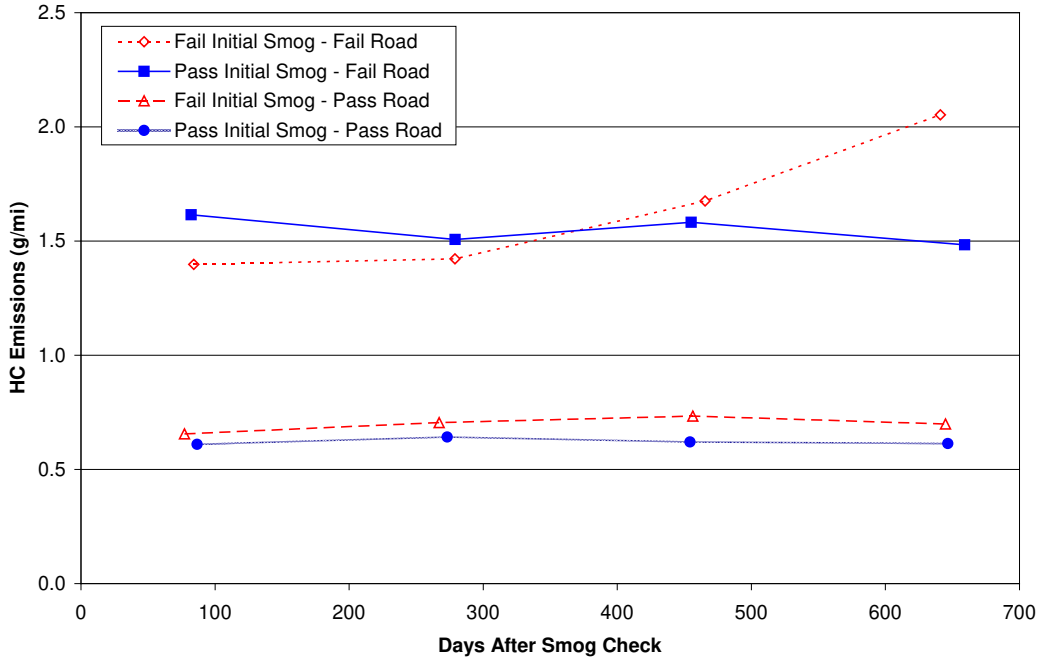


Figure 4-3

Roadside FTP CO Emission Rates for 1976-1995 Model Year Vehicles Versus Time After a Passing Smog Inspection

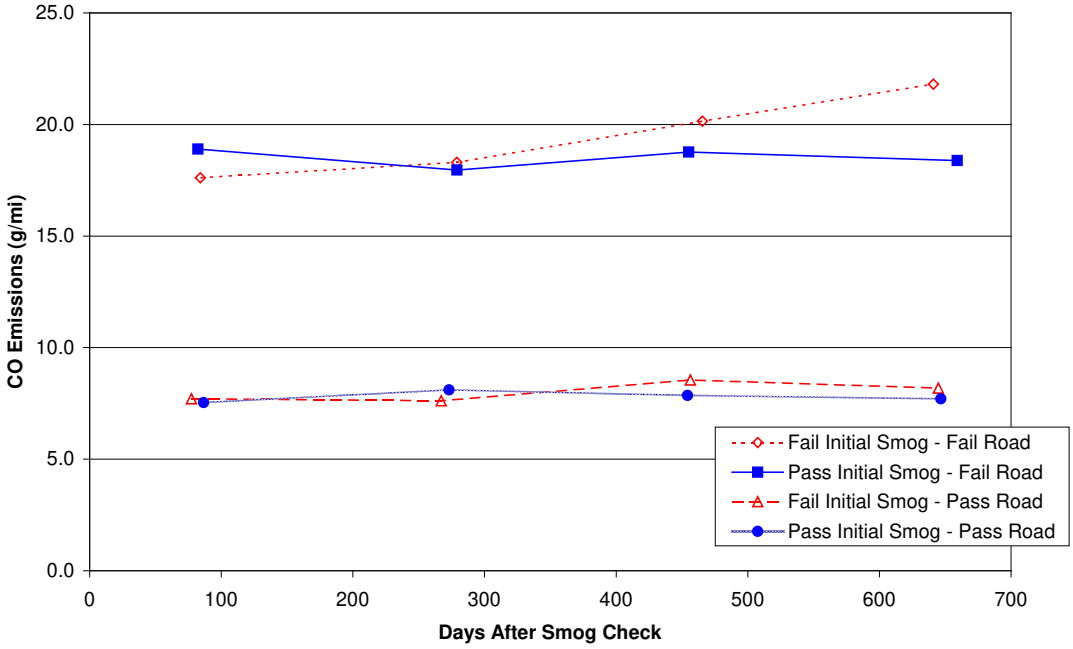
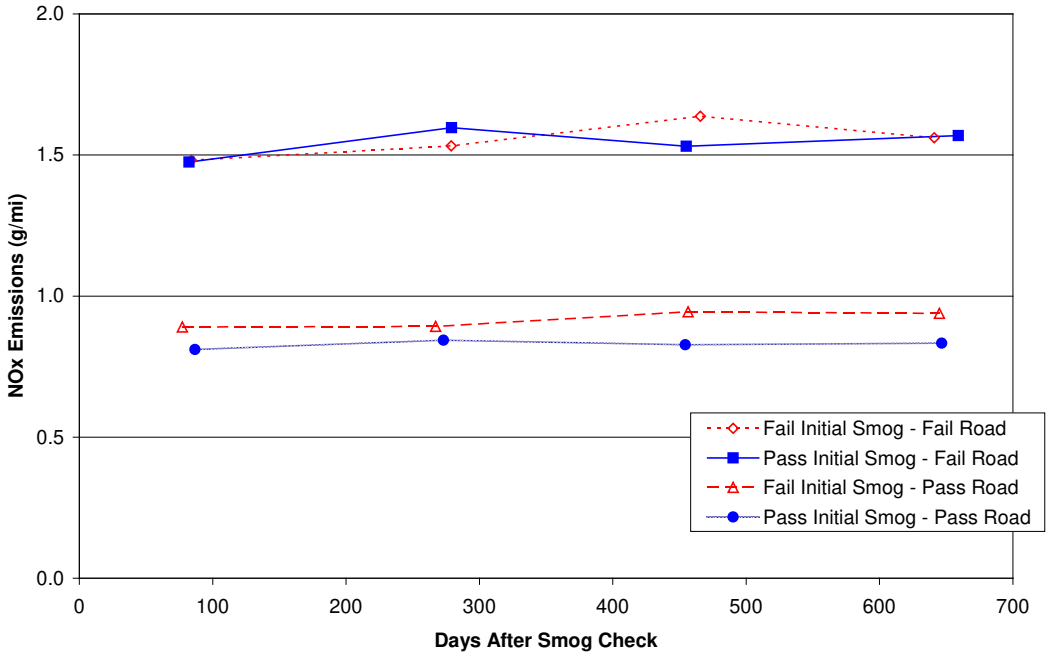


Figure 4-4

Roadside FTP NOx Emission Rates for 1976-1995 Model Year Vehicles Versus Time After a Passing Smog Inspection



The minimum sample size for the data points shown in Figures 4-2, 4-3, and 4-4 was 98 (for the "Fail Initial Smog – Pass Road" category in the 18-27 month time period). All other data points represent a minimum of 120 tests for vehicles that initially failed in the previous Smog Check cycle. There were a minimum of 225 tests at each data point for vehicles that initially passed in the previous Smog Check cycle and failed at the roadside. For vehicles that initially passed during the previous Smog Check cycle and passed at the roadside, the minimum sample size was 676.

Failures Due to Test-to-Test Variability

An analysis was also conducted to determine whether the higher roadside failure rates observed for vehicles that initially failed their last Smog Check might have been due to test-to-test variability. Test-to-test variability could be a factor if vehicles that initially failed their last Smog Check were closer to the standard when they ultimately passed the test. Vehicles that were marginally passing the test would be more likely to fail a subsequent test due to test-to-test variability. Test variability is especially a concern with older, carbureted vehicles without feedback control of fuel metering. However, as shown in Table 4-6, there was no significant difference in the average passing scores during the last Smog Check between vehicles that initially failed and vehicles that initially passed.

Table 4-6
Final Smog Check Emissions Prior to Roadside Test
(Percent of Applicable Standard)

	HC1	CO1	NO1	HC2	CO2	NO2
Initial Pass	56.8%	25.6%	46.5%	45.5%	18.5%	32.4%
Initial Fail	52.6%	21.6%	45.5%	45.7%	17.2%	37.3%

Note: "HC1" is the hydrocarbon standard for the ASM1 test; HC2 is the standard for the ASM2 test.

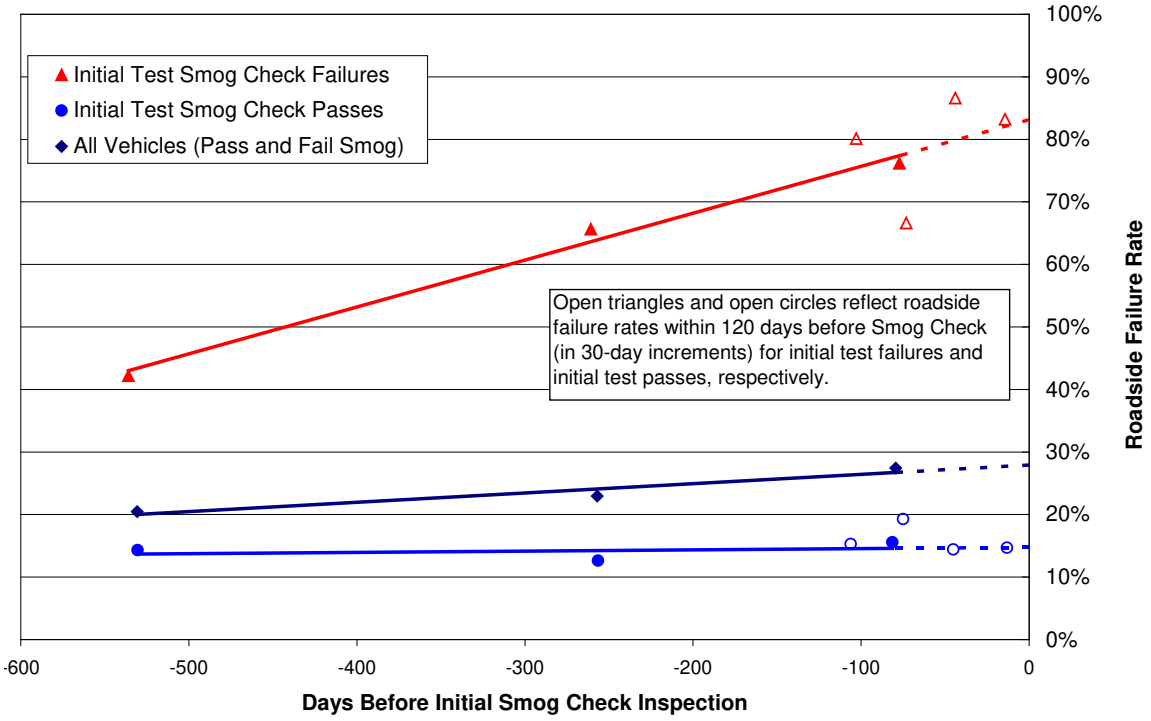
Failures Due to Tampering

Further data analysis of vehicle inspections at the roadside indicated a tampering problem with only about 9% of the vehicles. (This is higher than the <5% tampering rate reported by Smog Check stations; however, under-reporting of tampering by Smog Check stations has been a problem since the beginning of the program.) Considering all of the vehicles that were tested at the roadside, the tampering rate for vehicles that initially failed during their previous Smog Check cycle (9%) was not significantly different from the tampering rate for vehicles that initially passed their Smog Check (8%). Therefore, the high failure rates immediately following the Smog Check inspection do not appear to be explained by owner tampering following a passing test.

Failures Prior to Smog Check

For comparison purposes, an analysis was also conducted of the initial Smog Check test performed subsequent to a roadside test. Figure 4-5 displays the roadside overall ASM failure rates for the 1976-1995 model year vehicles that received an initial Smog Check inspection within 27 months following participation in the roadside program. The minimum sample size for each data point was 121.

Figure 4-5
Roadside Tailpipe ASM Failure Rates for 1976-1995 Model Year Vehicles Leading Up to a Smog Check Inspection



The "Initial Test Smog Check Failures" line reflects the average roadside failure rate for vehicles at specified times prior to failing their next initial Smog Check inspection. Extrapolation of these results implies that only 83% of the vehicles would fail a roadside test if it were performed immediately prior to a failing Smog Check. Test-to-test variability may be contributing to why some vehicles that failed a subsequent Smog Check were previously recorded as passing during a roadside test.

The "Initial Test Smog Check Passes" line reflects the average roadside failure rate at specified times prior to passing their next initial Smog Check inspection. This line implies that 15% of the vehicles would fail a roadside test performed immediately prior to a passing Smog Check. It should be noted, however, that some of these vehicles likely would have received pre-inspection maintenance prior to the Smog Check test.

When comparing Figure 4-5 with Figure 4-1, it should be noted that the roadside failure rate for vehicles that fail their initial Smog Check is almost twice as high immediately before the Smog Check cycle as it is after the Smog Check cycle. Assuming that repairs were performed during the Smog Check process, the repair results would have been successful for about half of the failing vehicles.

In Figure 4-5, it is also interesting to compare the projected Smog Check failure rates of the passing and failing vehicle groups following a roadside inspection. The failing vehicles are approximately 15% below 100% on the vertical axis, while the passing vehicles are also 15% above 0%. This similarity may reflect undetermined differences between the two test protocols, the repeatability of the ASM test, or a combination of both.

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5. STATION PERFORMANCE ANALYSIS

Conceptually, the optimum method for measuring the effectiveness of a Smog Check station would be to measure the emissions of a random sample of vehicles before and after they have been tested and, if necessary, repaired at the station. To determine the durability of the repairs, vehicles would be recruited for off-cycle emissions testing periodically. It would also be necessary for the Smog Check station to be unaware of which vehicles were part of the random sample to ensure that vehicles were not receiving special treatment. One difficulty in conducting such a program is that there is no practical way to include vehicles owned by routine customers in the random sample.

Because of the logistical problems associated with using a routine testing program of the type described above, BAR has attempted to use more readily available information to determine the relative performance of Smog Check stations. Since the early days of the program, different performance metrics have been considered and tested by BAR, Sierra, and ERG staff, including a number of versions designed to identify stations that were performing fraudulent or improper testing. Details of the "Station Performance Algorithm" that BAR has developed are confidential, but they involve monitoring the performance of individual vehicles over multiple Smog Check cycles. The algorithm accounts for a number of factors such as vehicle age, make, model, previous inspection result, odometer, etc. These factors compensate for those vehicles that inherently fail at a higher rate without penalizing stations whose clientele comprises a significant portion of these vehicles.

Data were provided by BAR to Sierra in August 2006. As evaluated in this report, the data consisted of a list of stations and their performance using a prototype Station Performance Algorithm incorporating the above factors and research. Only higher volume stations were considered in the evaluation since the volume of data from these stations provided a large enough sample for statistical analysis. Subsequent to this analysis, BAR has continued to evaluate and refine the Station Performance Algorithm.

For this evaluation, station performance scores were assigned on a continuum from 0 to 1.0, with a score of 1.0 being the best. The Roadside Inspection Program results were used to independently evaluate station performance and the effectiveness of the score produced by the prototype Station Performance Algorithm. Since truly high-performing stations ensure that the vehicles they certify actually meet the applicable emissions standards and are free from visual and functional defects, vehicles certified by such stations should be more likely to pass during subsequent roadside inspections.

This analysis was performed using the previously described February 2003 through April 2006 roadside dataset. Below are the two scenarios evaluated in this analysis. Each scenario has different criteria to identify high-performing and low-performing stations:

- Scenario 1: High-Performing designation is based on a station performance score greater than or equal to 0.9 and Low-Performing designation is based on a score less than or equal to 0.1.

- Scenario 2: High-Performing designation is based on a station performance score greater than or equal to 0.975 and Low-Performing designation is based on a score less than or equal to 0.025

Everything between the high and low performance thresholds is considered to be medium-performing stations for this analysis.

The roadside data were placed into model year group bins as follows: 1976-1980; 1981-1984; 1985-1987; 1988-1991; and 1992-1995. Vehicle model years 1996 and newer were not evaluated because of their small sample size in the roadside data and relative low number of failures.

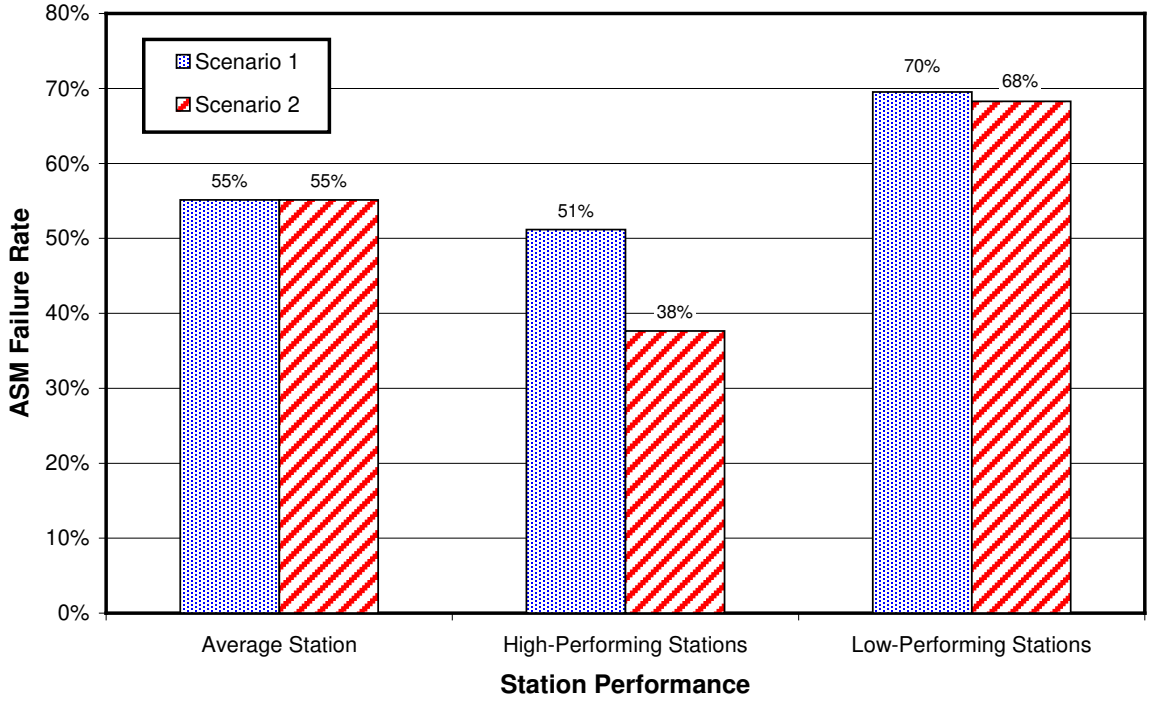
The percentage of roadside vehicles that were last certified by high-, medium-, and low-performing stations in this dataset is summarized below for the two scenarios. The numbers in parentheses under the "Performance" column are the number of Smog Check stations in each group. The numbers in parentheses under the "Roadside Tests" column are the number of vehicles in each group:

Scenario	Performance	Roadside Tests
1	High-Performing (306)	25% (1338)
	Medium-Performing (1103)	54% (2845)
	Low-Performing (323)	20% (1071)
2	High-Performing (118)	12% (655)
	Medium-Performing (1449)	76% (3972)
	Low-Performing (165)	12% (627)

Thus, under Scenario 1, the high-performing stations issued about 25% of the Smog certificates prior to the vehicles' roadside inspections, and the low-performing stations issued about 20%. Scenario 2 shows the high- and low-performing stations each issuing about 12% of the certificates prior to roadside inspections. The medium-performing stations make up the difference in both the scenarios.

Figure 5-1 displays VID-weighted 1976-1995 model year failure rates for these vehicles when tested in the Roadside Inspection Program. These particular vehicles failed their initial inspection and then passed Smog Check certification within a year prior to being

Figure 5-1
Roadside Failure Rates for Vehicles Failing Previous Initial Smog Inspection Prior to Certification within One Year of the Roadside Test (VID-Weighted 1976-1995 Vehicle Distribution)



Note: "Average Station" covers High-, Medium-, and Low-Performing stations. Failure rates are based on a subset of the Roadside sample for which station rankings were available and VID-weighting does not precisely match that used in other calculations.

tested in the Roadside Inspection Program. The ability of the Station Performance Algorithm to identify high-performing stations is evident when comparing the two scenarios. In Scenario 1, the roadside failure rate was 51% for the high-performing stations and was 38% in Scenario 2.[12]

At the other end of the spectrum, relatively little difference was noted for the low-performing stations under both scenarios. Vehicles that had been tested at these stations exhibited a failure rate of 68-70% when tested at the roadside.

It should be noted that 79% of the Smog Check stations involved in this analysis (1,493 out of 1,886) were Test-Only stations. Because repairs are not performed at Test-Only stations, Test-Only stations with a low rank sometimes appear to be inappropriately passing vehicles that should have failed.

[12] It should be noted that the overall failure rates from this analysis do not match the failure rates in the entire roadside sample because the station performance was not available for all of the vehicles tested at the roadside.

Using the two performance scenarios above, several calculations were performed, as described below.

Table 5-1 presents the potential emissions benefits of sending all 1976-1995 model year vehicles to high-performing stations under this analysis. The impact of Station Performance on the emission reductions achievable from the Smog Check program was estimated based on the assumption that the level of performance achieved by high-performing stations could be achieved by all stations. The results show that sending all 1976-1995 vehicles to the top 25% of the stations (Scenario 1) could achieve as much as 51.9 tpd statewide ROG+NOx emission benefit, and sending all 1976-1995 vehicles to the top performing 12% of the stations (Scenario 2) could achieve as much as 69.5 tpd ROG+NOx benefit (both on an EMFAC basis). This is nearly a 30% increase in Smog Check program benefits for this model year group.

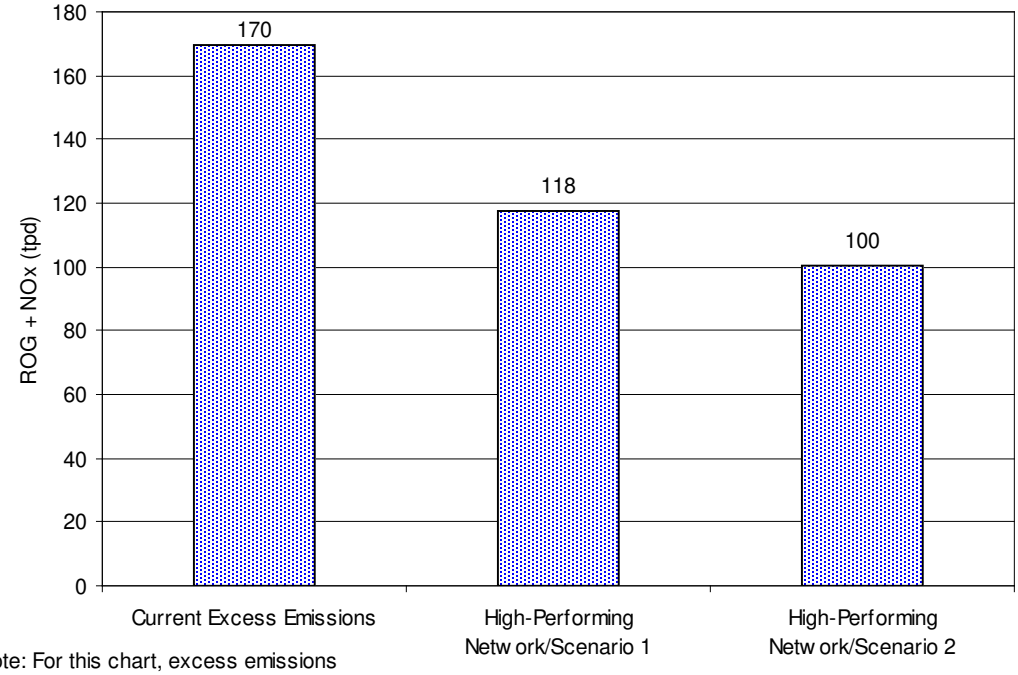
Table 5-1
CY2005 Statewide Emissions Benefits if All 1976-1995 Model Year Vehicles Were Tested at High Performing Stations
(tons per day)

Scenario	ROG	CO	NOx	ROG+NOx
1	22.4	415.5	29.5	51.9
2	32.2	536.8	37.3	69.5

Figure 5-2 shows the excess emissions associated with 1976-1995 model year vehicles under the current Smog Check program as well as the excess emissions that would be expected if all 1976-1995 model year vehicles were tested at the highest-performing stations based on a best case scenario. For this analysis, excess emissions were calculated as the difference between the roadside data (converted to an FTP and then EMFAC basis) and the emissions if all of the vehicles passed the roadside ASM test. The difference between the current excess emissions of 170 tons per day ROG + NOx and the potential excess emissions of 100 tons per day ROG + NOx if all vehicles were inspected at "high-performing" stations as they are defined under Scenario 2 is the 69.5 tons per day shown in the last column of Table 5-1. The remaining 100 tons per day of excess emissions is approximately equal to the expected performance of the Smog Check program estimated by the EMFAC model (i.e., the Smog Check program was never expected to eliminate all excess emissions). Based on EMFAC, the Smog Check program is capable of reducing emissions from this model year group by 315.8 tons per day using relatively high-performing stations.

Figure 5-2

CY2005 Statewide Excess ROG+NOx Emissions from 1976-1995 Model Year Vehicles (Based on Roadside Data Converted to an EMFAC Basis)



Note: For this chart, excess emissions are defined as the difference between roadside emissions and emissions assuming all vehicles passed the ASM.

Station Performance and Repair Data Analysis

Repairs performed during the Smog Check process are reported to BAR through the VID. A repair dataset analyzed in conjunction with the Roadside data (February 2003 to April 2006) and station performance data were provided by BAR.

The repair dataset provided by BAR included more than 4 million repair records, primarily dated between January 1998 and August 2005. A total of 1,859 repair records were identified for vehicles in the Roadside dataset. Of these, 1,038 were repair records for vehicles repaired by stations included in the August 2006 station performance dataset. The 1,038 records were further segregated into two bins, one for repairs performed within one year prior to the roadside inspection (147 tests found) and two years prior to the roadside inspection (342 tests found). The sample size of these two bins was considered insufficient for determining if patterns could be detected in the repairs performed on vehicles that received both a Roadside and station inspection by a station included in the station performance dataset. Thus, the repair datasets were augmented to include all repair records after January 1, 2000, resulting in a total of 870 repair records being used for this analysis.

The Smog Check program records repairs for 13 major categories that are broken into 76 subcategories. The following 10 major categories and some of their subcategories were used for this initial analysis:

Ignition	Spark plugs, ignition wires, cap, rotor, timing, coil
EGR	Vacuum, valve, clean passage, controls
Sensors	O_2 sensor, temperature, throttle position, MAP, MAF, crank position, cam position
Carburetor	Fuel filter, air filter, adjust, rebuild/replace
Catalyst	Catalyst
Fuel Injection	Fuel filter, air filter, pressure regulator, throttle body, fuel distributor, injectors, cold start
Mechanical	Vacuum leaks, cylinder, top end, valve train, lower end, intake manifold, turbo
AIR	Air pump, pulse valve, diverter valve, belt, plumbing, check valve
Controls	Mixture control, spark control, purge solenoid, idle speed, EGR solenoid, diverter valve
ECM	Engine control module (computer)

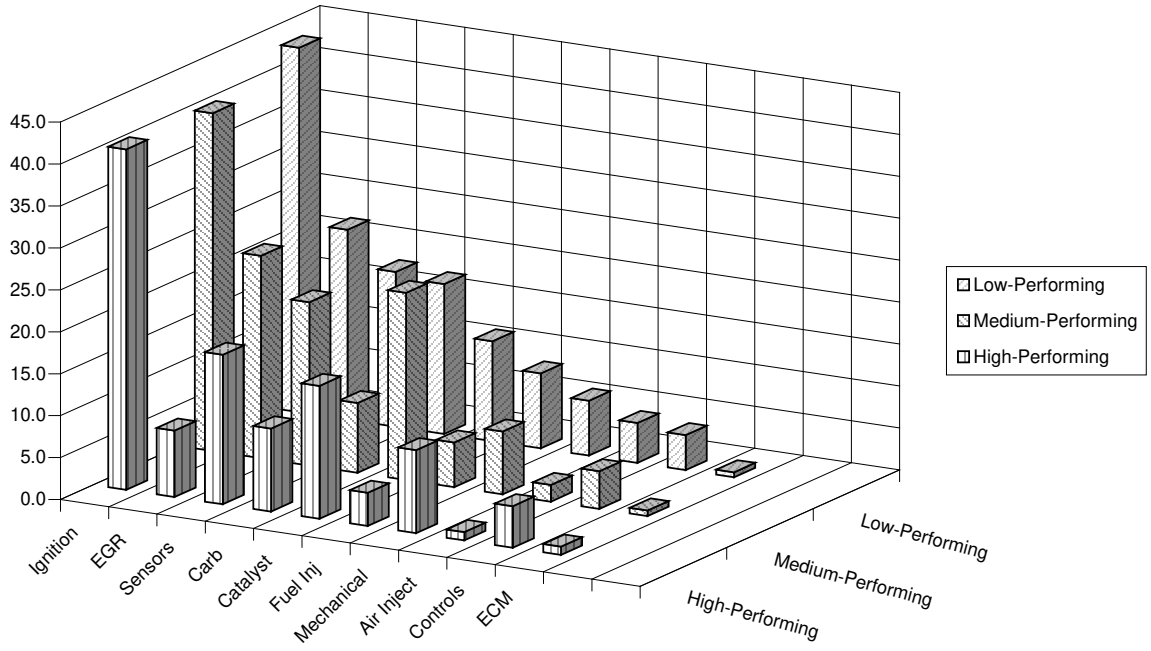
The stations performing repairs were divided into three previously defined groups: high-, medium-, and low-performing stations. This initial analysis was performed to determine whether there is a pattern in the types of repairs performed based on the station's performance.

Table 5-2 compares, on a percentage basis, the type of repair reported for vehicles later inspected on the roadside, with the numbers in bold type highlighting some of the more notable results.

Figure 5-3 displays the results graphically. It is possible (even likely) for multiple repair groups to be reported for a given vehicle. In this sample of 870 vehicle repair records, more than 40% of the records indicate a repair or adjustment to the ignition system, including plugs, wires, and associated components.

Table 5-2 Percentage of Repairs Performed by Stations in Different Performance Groups			
Repair Categories	Performance Group		
	Low-Performing	Medium-Performing	High-Performing
Ignition	43.5	40.3	40.6
EGR	22.6	24.1	**7.9**
Sensors	18.5	19.5	17.8
Carburetor	**17.9**	8.3	9.9
Catalyst	11.9	22.3	15.8
Fuel Injection	**8.9**	5.3	4.0
Mechanical	6.6	7.5	9.9
Air Injection	**4.8**	2.0	1.0
Controls	4.2	4.5	5.0
ECM	0.6	0.7	1.0

Figure 5-3
Comparison of Repairs Performed by Stations in Different Performance Groups



In this limited sample, some results are questionable. For example, it is surprising to see that the higher performing stations performed substantially fewer EGR repairs than the medium and lower performing stations. Also surprising is that lower performing stations performed repairs more frequently in the categories of Carburetor, Fuel Injection, and Air Injection, which are generally considered to be more difficult and time-consuming

repairs. Given these results, the accuracy of the repair data are questionable. While BAR wants technicians to enter data for all repairs, it is clear that they do not. From these results, it appears that low-quality repairs, in particular, are not being entered.

Of particular interest, the lower performing stations in this group performed the fewest catalyst replacements, which is counterintuitive and contradicts a common theory regarding use of a cheap aftermarket catalyst to temporarily mask a problem without repairing the root cause.

It may be useful to obtain all of the repair information for a larger vehicle population to which the Station Performance Algorithm could be applied. The limited available sample size prevents drilling down for the more detailed information in the repair subcategories, as only one or two repairs were reported in some of the categories. However, based on the sample analyzed here, it is uncertain whether the repair data are sufficiently accurate for an expanded analysis to be meaningful.

Repair data are recorded by a vehicle's VIN and date of repair. It is common for multiple tests to be performed on vehicles needing repairs, but the repair record is not linked to any specific test. It is likely that many repair records were not properly matched with the appropriate test record. Improving that link might improve the usefulness of this type of investigation.

It would be useful to analyze repair records for a large sample of vehicles that failed a Smog Check in 2006, were subsequently repaired and certified, and then received a biennial test in 2008. A larger sample size might provide additional insight as to the type of repair associated with the failure of different pollutants. Information gathered by such analysis, incorporating repair durability as measured by "Pass/Fail" results during the next test cycle, might also be of interest to service technicians and station owners. However, the value of such an analysis will ultimately depend on whether the repair data are sufficiently accurate.

Repairs are reported in the Emission Inspection System under the following categories: "Tampered and Repaired"; "Repaired"; "Diagnosed OK"; and "Estimated to Need Repair." For this analysis, emission control systems reported as "Tampered and Repaired" were combined with systems that were "Repaired" to evaluate emissions performance. Additional analysis of the other repair categories, such as the "Estimated to Need Repair" category, might also be of interest.

In summary, although the repair analysis in this section provides some interesting information, the small dataset prevents drawing any meaningful conclusions. Further analysis of station performance based on a larger repair dataset may provide additional insight into the reasons behind the roadside failure rate.

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6. ADDITIONAL ANALYSES

As previously described, the Roadside Inspection Program data included tests performed between February 2003 and April 2006. Standard Smog Check program results for the vehicles included in the Roadside dataset were merged by VIN for additional analysis. Smog Check results from January 2000 through April 2006 were available at the time these analyses were performed. Additional data were made available in December 2007, extending the available Smog Check results through October 2007. These additional results were merged with the previous datasets. Spot checking the additional Smog Check results showed that these additional data had no impact on previous analyses discussed in this report. The new data were used in the more recent analyses described in this section of the report.

This section also includes a brief summary of the focus group study conducted by subcontractor Eastern Research Group (ERG) during the summer of 2007. Attachment 1 contains more detailed results of the focus group study.

Significant Rates of Aborted Tests, Training Mode Tests, and Pretests

An analysis was done to determine whether a significant number of vehicles failing a roadside inspection were also subject to a high number of aborted tests, training mode tests, or pretests during the Smog Check inspection cycle. It should be noted that a pretest does not necessarily indicate a pattern of misbehavior. In addition, there are legitimate reasons for aborting tests, many of which are related to safety or some of the BAR 97 software features that ensure accuracy of the analyzer.

As with the previous analyses, the merged Roadside/Smog Check datasets were used as a starting point for this analysis. Initially, all Smog Check records for vehicles failing the roadside test were retained. All tests performed prior to the previous passing Smog Check cycle were removed. The remaining records in the final cycle were then scanned for Aborted Tests, Training Mode Tests, and Pretests, and each category was summed by vehicle type. Results are displayed in Table 6-1.

Table 6-2 presents the same information for vehicles that passed the roadside test. Aborted tests accounted for only 5.83% of the Smog Check tests for these vehicles, which compares to 13.56% aborted tests for vehicles failing at the roadside. Although pretests do not necessarily indicate that a technician has done something wrong, pretests were 8.95% of the Smog Check tests of roadside passing vehicles, which compares to

Table 6-1
Total Count of Previous Smog Check Test Result Outcome Types
Vehicles Failing Roadside Tailpipe Inspection

Body Type*	Total Gross Polluter	Total Tamper	Total Abort	Total Hands-On	Total Training	Total Pretest	Total Pass	Total Fail	Total Fail -w-Pretest
0	0	0	1	0	1	0	4	0	0
1	216	27	160	0	16	213	1096	461	65
2	14	3	7	0	0	16	77	31	3
3	104	18	50	0	5	78	406	121	21
4	30	6	10	0	2	12	119	28	2
5	24	3	17	0	1	24	150	46	7
6	11	5	10	0	0	17	75	15	6
Total	**399**	**62**	**255**	**0**	**25**	**360**	**1927**	**702**	**104**
%**	**21.22**	**3.30**	**13.56**	**0.00**	**1.33**	**19.15**	**102.50**	**37.34**	**5.53**

* 1=sedan, 2=station wagon, 3=pickup, 4=SUV, 5=minivan, 6=larger van, 0=other
**Percentage based on category sum divided by number of unique VINs contained in sample = 1880

Table 6-2
Total Count of Previous Smog Check Test Result Outcome Types
Vehicles Passing Roadside Tailpipe Inspection

Body Type	Total Gross Polluter	Total Tamper	Total Abort	Total Hands-On	Total Training	Total Pretest	Total Pass	Total Fail	Total Fail -w-Pretest
0	1	0	0	0	1	0	9	0	0
1	138	44	188	2	34	261	3322	536	64
2	12	1	13	0	2	19	172	35	6
3	51	21	61	0	4	92	959	150	25
4	17	2	20	0	0	26	425	60	9
5	18	7	9	0	3	45	398	65	14
6	11	2	8	0	2	16	104	18	4
Total	**248**	**77**	**299**	**2**	**46**	**459**	**5389**	**864**	**122**
%*	**4.83**	**1.50**	**5.83**	**0.04**	**0.90**	**8.95**	**105.03**	**16.84**	**2.38**

*Percentage based on category sum divided by number of unique VINs contained in sample = 5131

19.15% pretests for roadside failing vehicles. Training mode tests were also lower for roadside passing vehicles. As the tables show, the frequency of Smog Check aborted tests, training mode tests, and pretests for roadside failing vehicles are more than double those observed in roadside passing vehicles. For comparison, a similar analysis was performed using a single recent month of Smog Check Program data. The frequency of each category fell between the results shown for roadside passing and roadside failing vehicles.

In summary, the frequency of these test activities could indicate, in some cases, questionable station performance needing further review.

Vehicle Manufacturer Failure Rate – Roadside Versus Smog Check

The failure rate for vehicles in the 2003-2006 Roadside dataset was compared to Smog Check results for April 2004.[13] Only valid test results were used so both the Roadside and Smog Check datasets were purged of all "Abort," "Pretest," and "Training" inspection records prior to the analysis. To maintain consistency with the earlier analyses, only results for model years 1974-1995 were considered. To account for the stratified sampling protocol used in the Roadside Inspection Program, the results were further weighted to match the April 2004 VID Model Year distribution. The results were then segregated into vehicle manufacturer group, and the individual vehicle manufacturer's roadside failure rate was divided by the Smog Check failure for comparison. These results are displayed in Table 6-3.

The results shown in Table 6-3 were sorted by test volume per vehicle manufacturer, and only the higher volume vehicle manufacturers are shown. Lower volume vehicle manufacturers were grouped together under the heading of "Other." As previously observed, the roadside failure rate was generally double that observed in the Smog Check program.

There do not appear to be significant differences in the ratio of roadside to Smog Check failure rates by vehicle manufacturer.

Table 6-3
Smog Check versus Roadsides Failure Rate by Vehicle Manufacturer
(Weighted to April 2004 VID)

	Roadside	Smog Check	Roadside	Road/VID
Manufacturer	Sample	Failure %	Failure %	Ratio
GM	1340	14%	26%	1.89
Toyota	1218	12%	22%	1.9
Ford	1155	10%	21%	2.11
Honda	812	13%	26%	1.96
Nissan	520	11%	20%	1.87
Chrysler	453	14%	32%	2.2
Other	621	15%	31%	2.07

[13] Smog Check data for 2004 were used so that the average vehicle age and vehicle-miles-traveled (VMT) of the fleet would remain consistent with the 2004 Roadside dataset.

Vehicles Receiving Improper Test Type Prior to Roadside Inspection

An analysis was performed to identify whether a significant number of vehicles tested during the Roadside Inspection Program received and passed a less stringent two-speed idle (TSI) test rather than the ASM test as part of their previous Smog Check inspection cycle. The vehicles contained in the 2003-2006 Roadside Inspection Program dataset were matched (by VIN) with Smog Check data from 2000-2007 to include all Smog Check tests performed within one biennial cycle of the roadside inspection. Once matched, all Smog Check records that occurred after the vehicle's roadside inspection date were removed from the dataset. The remaining vehicles were then examined by inspection type.

Vehicles that require an ASM test are identified in the VID. Certain vehicles cannot be ASM tested, including vehicles equipped with full-time All Wheel Drive (AWD), vehicles equipped with Traction Control (TC) that cannot be disabled, and vehicles that are physically too large to fit on the ASM test dynamometer.

The Smog Check technician's responsibilities include determining whether the vehicle is testable. When an inspection is initiated, the analyzer gets the registration zip code and determines the test type based on the zip code. For trucks and motor homes, the analyzer then prompts the technician to enter the gross vehicle weight rating (GVWR) or other information that would result in the replacement of the ASM test with a TSI test. The information in Table 6-4 shows where the GVWR exceeds the 8,500 maximum weight for ASM prior to May 1, 2003. After that date, the maximum was raised to 9,999 pounds to determine which vehicles get a Two Speed Idle (TSI) test. The table shows 21 out of 45 vehicles that exceed the earlier weight limit for the ASM and 4 vehicles that exceed the later weight cap. It appears that these vehicles were correctly tested with the TSI test even though they received an ASM test at the roadside.

Vehicles that the Smog Check station indicated could not be tested because of their weight, size, or drive configuration are identified with an entry in the column entitled "Reason" in Table 6-4. Since these vehicles were ASM tested at the roadside, the reason given for TSI testing by the Smog Check station appears to be invalid. Still other vehicles received a TSI test without a reason being given.

As indicated by boldface type, 20 of the 45 vehicles listed in Table 6-4 appear to have been improperly given a TSI test. However, they account for much less than 1% of the Roadside Inspection Program population and therefore do not explain the much higher failure rate observed in the Roadside program.

Table 6-4
Vehicles Receiving Two Speed Idle Tests in Smog Check Program
(**Bold Type** Indicates Apparently Incorrect Selection of TSI Test)

Model Year	Make	Smog Check Model	Roadside Model	Reason	Smog GVWR
1993	FORD	EXPLORER 4-DR	EXPLORER 4-DR	AWD	5280
1992	FORD	CLUB WAGON	E350 CLUB WAGON		8700
1992	**CADIL**	**STS**	**DEVILLE**	**AWD**	**n.a.**
1986	CHEVY	C20	C20 SUBURBAN		8600
1987	**GMC**	**SAFARI**	**SAFARI**	**Trac. Control**	**6000**
1985	CHEVR	C20 PICKUP	CAB CHASSIS	Too Heavy	8600
1991	**GMC**	**SAFARI AWD**	**SAFARI**	**AWD**	**6100**
1989	**CHEVR**	**ASTRO**	**ASTRO**	**Trac. Control**	**5600**
1976	CHEVR	G30 CHEVY VAN	G30 CHEVY VAN		10000
1979	FORD	F250 PICKUP	F250 PICKUP		10000
1997	MITSU	MONTERO	MONTERO SPORT		5000
1987	**NISSA**	**MAXIMA**	**MAXIMA**	**Trac. Control**	**n.a.**
1984	TOYOT	FLATBED	PICKUP		8600
1986	TOYOT	1 TON DUALEY	PICKUP		8601
1990	TOYOT	CAB/CHASSIS	CAB/CHASSIS	Too Big	8600
1991	TOYOT	PICKUP	CAB/CHASSIS	Too Big	8499
1992	**FORD**	**EXPLORER 4-DR**	**EXPLORER 4-DR**	**AWD**	**5240**
1991	**FORD**	**EXPLORER**	**EXPLORER**	**AWD**	**5180**
1993	**FORD**	**EXPLORER 4-DR**	**EXPLORER 4-DR**	**AWD**	**5280**
2000	FORD	EXCURSION	EXCURSION		8600
1994	**FORD**	**F150 SUPER CAB/SHORT**	**F150 REG CAB/ LONG**	**Too Heavy**	**6250**
1989	FORD	F250 PICKUP	F250 PICKUP	Too Heavy	8600
1991	FORD	F250	F250 PICKUP		8600
1993	FORD	F250 REG CAB – LONG	F250 PICKUP		8600
1985	FORD	TRUCK	F250 PICKUP		8600
1993	**CADIL**	**FLEETWOOD**	**FLEETWOOD**		**n.a.**
1982	CHEVR	G20 CHEVY VAN	G20 CHEVY VAN		8600
1981	CHEVR	C20 PICKUP	C20 PICKUP		8600
1988	CHEVR	CHEYENN	C3500 PICK UP		8600
1993	CHEVR	TRUCK	C3500 PICKUP		10000
1993	CHEVR	G30 CHEVY VAN	G30 CHEVY VAN		8600
1993	**GMC**	**S15 JIMMY 4WD**	**S15 JIMMY 2WD**	**AWD**	**5100**
1991	CHEVY	SUBURBAN 2500	K2500 SUBURBAN		8501
1984	CHEVR	C30 PICKUP	C3500 PICKUP		10000
1987	GMC	G3500 RALLY WAGON	C3500 PICKUP	Too Heavy	8600
1998	**JEEP**	**GRAND CHEROKEE**	**GRAND CHEROKEE**	**AWD**	**5000**
1990	FORD	F150 PICKUP	F150 PICKUP		5250
1997	**MERCU**	**GRAND MARQUIS**	**GRAND MARQUIS**	**Trac. Control**	**n.a.**
1991	**TOYOT**	**CAMRY**	**CAMRY**		**n.a.**
1989	**NISSA**	**240SX**	**240SX**		**n.a.**
1991	**TOYOT**	**CAMRY**	**CAMRY**		**n.a.**
1991	**TOYOT**	**PICKUP**	**PICKUP**	**Too Big**	**5820**
1993	**TOYOT**	**UTILITY**	**CAB/CHASSIS**	**Too Big**	**6500**
1978	**FORD**	**F250 PICKUP**	**F250 PICKUP**	**Too Big**	**7600**
2000	**VOLVO**	**C70 COUPE**	**C70**	**Trac. Control**	**n.a.**

Vehicles With Lookup Table ID Number Mismatches

The Vehicle Lookup Table (VLT) is used to identify the proper dynamometer loading for a vehicle based on such characteristics as Make, Model, Model Year, Engine, Transmission, and Body. Each unique combination is identified with a VLT row identification (ID) number. The previously described Roadside Inspection/Smog Check dataset was analyzed to determine how frequently the VLT row ID differed between the Smog Check and Roadside Inspection tests, and to identify the source of the differences. When technicians have to enter information manually, mistakes can occur; therefore, all of the discrepancies observed based on this analysis are not necessarily due to intentional data entry errors intended to affect the outcome of the test. Another source of error is misinformation in older look-up tables that were corrected by BAR around 2003. Nevertheless, the analysis provides an indication of the extent to which data entry errors are affecting test results.

Only the vehicle's roadside inspection and the settings used for the vehicle's most recent passing Smog Check inspection were examined. Smog Check inspections not resulting in a passing certificate, including pretest, training, and aborted tests, were removed. Smog Check results following the vehicle's Roadside Inspection date were also removed.

Of the 6,667 remaining roadside tests used for this analysis, 605 of the corresponding final Smog Check tests used a different VLT version. These were removed for this analysis, leaving 6,062 tests. Of the 6,062 remaining roadside/Smog Check test pairs, 799 (13.2%) reported use of different VLT row IDs.

Table 6-5 identifies the differences observed in the vehicle characteristics recorded for the 799 Roadside and Smog Check tests with differing VLT row IDs. The total number of mismatches (993) is greater than the number of tests because some vehicles had more than one mismatch.

Table 6-5
Mismatches in Vehicle Characteristics
Comparing Roadside and Smog Check Station Data

Characteristic	Mismatch	% of Total Mismatches
Model	347	43%
Engine Displacement	253	32%
Model Year	136	17%
Body Type	112	14%
Number of Cylinders	50	6%
Transmission Type	42	5%
Make	31	4%
Type (Pass or Truck)	22	3%

Initially, the Model names of all tests with mismatching VLT row numbers were inspected. It was apparent that a more productive approach would be to first segregate Body Types (sedans, wagons, pickups, SUVs, and vans), and then to examine Models within individual types.

The 799 row identification mismatches were compared with regards to the Body Type reported for the two tests. The results are displayed in Table 6-6.

Table 6-6
VLT Mismatch – Roadside versus Smog Check
By Vehicle Body Type

Body Type	Mismatch	Match	Mismatch (%)
Sedan	398	3319	11%
Station Wagon	49	133	27%
Pickup	215	912	19%
Sport/Utility	66	375	15%
Minivan	24	428	5%
Full-size Van	47	96	33%

Individual test results were then examined. For example, 49 Station Wagons with a mismatch between roadside and Smog Check VLT row number were identified. The only unusual pattern noted was a number of subcompacts, such as the Honda Civic, that were identified as either a sedan or a station wagon. This was attributed to confusion regarding how to classify a "hatchback" design.

The differences found in pickups, SUVs, and Vans were more significant. A common difference between the two datasets was the assignment of ½ Ton, ¾ Ton and 1 Ton models, as indicated by such names as F150, F250, and F350 or C1500 and C2500. The heavy-duty models can require substantially heavier test weight than the base models. A more subtle difference noted was the difference between two-wheel-drive and four-wheel-drive assignments. The four-wheel-drive versions of the full size vehicles frequently have assigned dynamometer test weights between 500 and 1000 pounds heavier than the two-wheel-drive versions.

The assigned test weights of all pickups, SUVs, and vans with mismatched VLT row numbers in the Smog Check and roadside datasets were averaged to determine if there was a bias between the datasets. The average weights of the two groups were within 10 pounds, indicating there was no systematic offset.

The next most common row ID discrepancies as shown in Table 6-5 include Engine Displacement, Model Year, Number of Cylinders, Transmission Type, and Make. Again,

individual tests with discrepancies were segregated and manually reviewed. The source of most of the differences appeared to be carelessness, where a technician in one program reported a four cylinder engine while a different technician reported a six cylinder engine. More significant was the number of times a vehicle would be tested in one program as a Camry, for example, and a Corolla in the other. However, no consistent bias in assigned test weight was found between the two datasets. Most of the issues resulting from these discrepancies should be addressed in the design of the BAR 2010 analyzer.

In summary, although there were cases where VLT mismatches occurred, none of these situations impacted the refail rate at the roadside.

Focus Group Study Results

Five separate focus groups were also used to investigate reasons for the high roadside failure rate of vehicles that initially failed during the previous Smog Check cycle. These focus groups were intended to provide insight into future potential areas of analysis.

A focus group consisting of BAR personnel suggested several technical differences between the roadside testing and the tests conducted at Smog Check stations that could explain differences in test results (e.g., differences in test conditions, test equipment, and equipment maintenance). However, these suggestions explain only relatively small differences that would not change the results of this analysis. In addition, BAR personnel and Smog Check station personnel mentioned the failure of inspectors to perform adequate visual and functional checks as contributors to the problem, along with the use of cheap, aftermarket catalysts.

BAR personnel, vehicle owners, Smog Check station managers, and technicians who participated in the focus groups all mentioned the possibility that some technicians might accept bribes to produce a falsified passing test result, but no one offered any real evidence of the extent to which bribery or illegal activities result in falsified test results.

The focus groups also revealed that incentives exist that likely reward low performance as it is more profitable for stations, and more affordable and convenient for motorists, when inspections are done quickly and cheaply, which often leads to improper and incomplete tests.

Attachment 1 contains more details about the focus group study.

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7. RECOMMENDATIONS

Based on the analysis described above, improper or falsified Smog Check results appear to be contributing to the 49% tailpipe failure rate at the roadside for vehicles that initially failed during the previous Smog Check cycle. While the existing BAR program has been successful in identifying some stations that produce falsified or incorrect test results, it cannot identify Smog Check stations that are willing to falsify a test result only for routine customers. None of the specially prepared vehicles used by BAR are taken to Smog Check stations by routine customers of the station.

To better address the extent to which improper and/or falsified test results may be factors in the Smog Check program, the following additional steps should be considered:

1. Further refine the Station Performance Algorithm and use it to target low-performing stations for increased enforcement and to create incentives for more stations to become high performing. Adding "fingerprint" analysis of OBD inspection results in Smog Check data is one of the approaches that could be included in the Station Performance Algorithm when the next generation of Test Analyzer Systems is deployed. If more detailed OBD results are collected by new analyzers, it should be possible to determine when a Smog Check station is reporting OBD inspection results that are inconsistent with the results that should have been generated for a particular make and model.[14]

2. Perform inspections of vehicles immediately following certification at Smog Check stations. This would facilitate the inspection of vehicles owned by routine customers that may be treated differently than vehicles unknown to the station. The options for accomplishing such inspections include roadside inspections of vehicles leaving Smog Check stations or on-site inspections of vehicles that are preparing to leave a station.

[14] A detailed explanation of how OBD "fingerprint" analysis might be performed is not considered appropriate for a report that may receive widespread distribution, but has been discussed with BAR and ARB privately.

3. Continue the Roadside Inspection Program. Using the results from this analysis as the baseline, continuation of the Roadside Inspection Program will enable the effectiveness of future Smog Check program improvements to be measured. Roadside data should also be used to target low performing stations for additional enforcement.

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Attachment 1

Summary of Smog Check Focus Group Study

Summary of Smog Check Focus Group Study

August 20, 2007

Prepared for:

California Air Resources Board
California Bureau of Automotive Repair

Prepared by:

Eastern Research Group

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Introduction

Based upon results from the random roadside inspection program, high emitting vehicles are passing at Smog Check stations at a high rate. In other words, vehicles that passed their regular Smog Check inspection were found later (by roadside inspection) to have probably passed by error or fraud. The goals of this task are to obtain information on the motivations for non-compliant behavior ("Why" questions), and to identify the different ways in which a high-emitting vehicle may receive a Smog Check certificate ("How" questions).

ARB and BAR wanted to collect information to identify possible causes for the observed problem. A well-run focus group is an ideal tool for gaining new insights into real world program operation. Synergy between focus group participants can drive discoveries and insights far more quickly than is possible with individual interviews. However, focus groups must be well-run by a facilitator who prevents group domination by just one or two participants or by the force of individual agendas.

Eastern Research Group (ERG) led this task by helping design and prepare the focus group materials, identify participant groups of interest, arrange facilities, pay incentives, and report the results. ERG was aided by SDV/ACCI, who performed the recruiting and provided a focus group facilitator, Brian Fowler.

Participant Groups of Interest

ERG consulted with ARB and BAR to determine the best persons to target for these focus groups. There are both legitimate and illegitimate reasons for the discrepancy between Smog Check inspections and roadside inspections results. To best identify and understand these reasons, we felt it would be important to talk not only to technical experts, such as BAR personnel, inspectors, and repair technicians; but also to vehicle owners themselves, who probably can have a significant role in the outcome of an inspection.

Vehicle owners eligible to participate were identified by their experience with the program. The two types of vehicle owners we recruited had all been through the Smog Check program, and then received a roadside inspection within a year that they 'failed.' Some of them had passed their regular Smog Check on the first try and some had failed and then passed Smog Check (presumably after being repaired).

ARB and BAR expressed a desire to understand if inspectors and repair technicians had different opinions about how to improve Smog Check, based upon how competent they appear to be. To determine if a significant knowledge gap existed between experts thought to be competent and those thought to be incompetent, we broke this group into four categories: 'hands-on' personnel with BAR (enforcement technicians, field representatives, roadside technicians, etc.); station managers and technicians thought to be 'high-performing' (based upon the experience of BAR), those thought to be 'lowperforming,' and those who had either received citations or had their licenses revoked.

Focus Group Questions

ERG worked with ARB and BAR to develop a list of questions for each focus group. Vehicles owners were to be asked about their experience with the program, things they see wrong with it, and ways they see to improve it. BAR personnel, station managers, and technicians were to be asked primarily about things they see wrong with the program and ways they believe it could be improved.

The lists are in the form of a script. They begin with an introduction of the reasons for the focus groups. Then they touch on each of the following subjects.

- Legitimate ways vehicles can pass the inspection when they should have failed it.
- Opinions on 'gaming' the test process
- The roles of repairs in the high re-fail rate during roadside inspections
- How motorists could be responsible
- Opinions on how Smog Check could be improved

We have attached the questions as appendices for the reader's reference. The script of questions used for vehicle owners is reproduced in Appendix A and the scripts used for station managers, technicians, and BAR personnel are reproduced in Appendix B.

Recruiting

Recruiting participants for each focus group was a case of identifying persons who fit the criteria for each group, determining the best location to recruit near, then randomly contacting all qualifying persons in that area until enough volunteers had been obtained. This necessarily involved handling confidential consumer information, so protecting identities from unauthorized use was extremely important.

Data Security

Since deciding upon focus group recruits would involve handling personal information of consumers, confidentiality was of serious concern. Therefore, any person who was to handle private information was required to sign several agreements with the state. The first agreement was a memorandum of understanding (MOU) with the BAR. In summary, the MOU required that persons with confidential information follow applicable state and federal laws, and that they follow certain documentation procedures. The second agreement was with the Department of Motor Vehicles (DMV). It was their Information Security Agreement, and it limited the sharing of personal information and stipulated security procedures for handling the information.

Identifying and Recruiting Participants

A focus group for this type of study typically contains 3 to 6 participants. Any more will discourage some from participation, which is a waste of incentives budget. Any less becomes more of a one-on-one interview. A standard 'rule of thumb' when recruiting focus groups of this size is to obtain commitments from 8 recruits, with the idea that about 2 out of the 8 will typically not show up at the appointed time and place. A further assumption is that a typical response rate to telephone recruiting (at an incentive of $100 for 1.5 hours) is about 10%, so one in ten persons called will agree to participate. Therefore, we figured that approximately 80 persons would have to be called for each focus group to obtain commitments from 8 persons.

ERG worked with BAR engineering to identify potential recruits fitting the criteria for each focus group (as described previously). For the BAR personnel group, ERG relied upon BAR alone to provide a list of recruits from their own staff and to recruit those individuals. With approval of ARB and BAR, we decided to conduct the focus group for BAR personnel first, in Sacramento. This would allow training our moderator and could serve as a test of the questions with a group of professionals. A further advantage of conducting the first group with BAR personnel was that any information needed after the focus group could be reliably obtained through written, follow-up questions.

For vehicle owners ERG first produced a list of license plates that fit the criteria for participation (i.e., that the vehicle had gone through a Smog Check cycle soon before a roadside inspection). BAR then matched the list to the registration database at DMV and provided ERG the names and addresses of the vehicle owners. This produced a list from which to recruit vehicle owners. For the manager/technician groups, BAR provided a list of all stations and technicians in the state and a list of stations and technicians that fit the criteria for the three focus groups (i.e., identified as high-performing, low performing, or having received a citation or revocation of license). ERG then matched the names, addresses, and phone numbers from the master list of the stations and technicians to the focus group qualifying lists provided by BAR. This produced three more lists from which to recruit the three remaining focus groups.

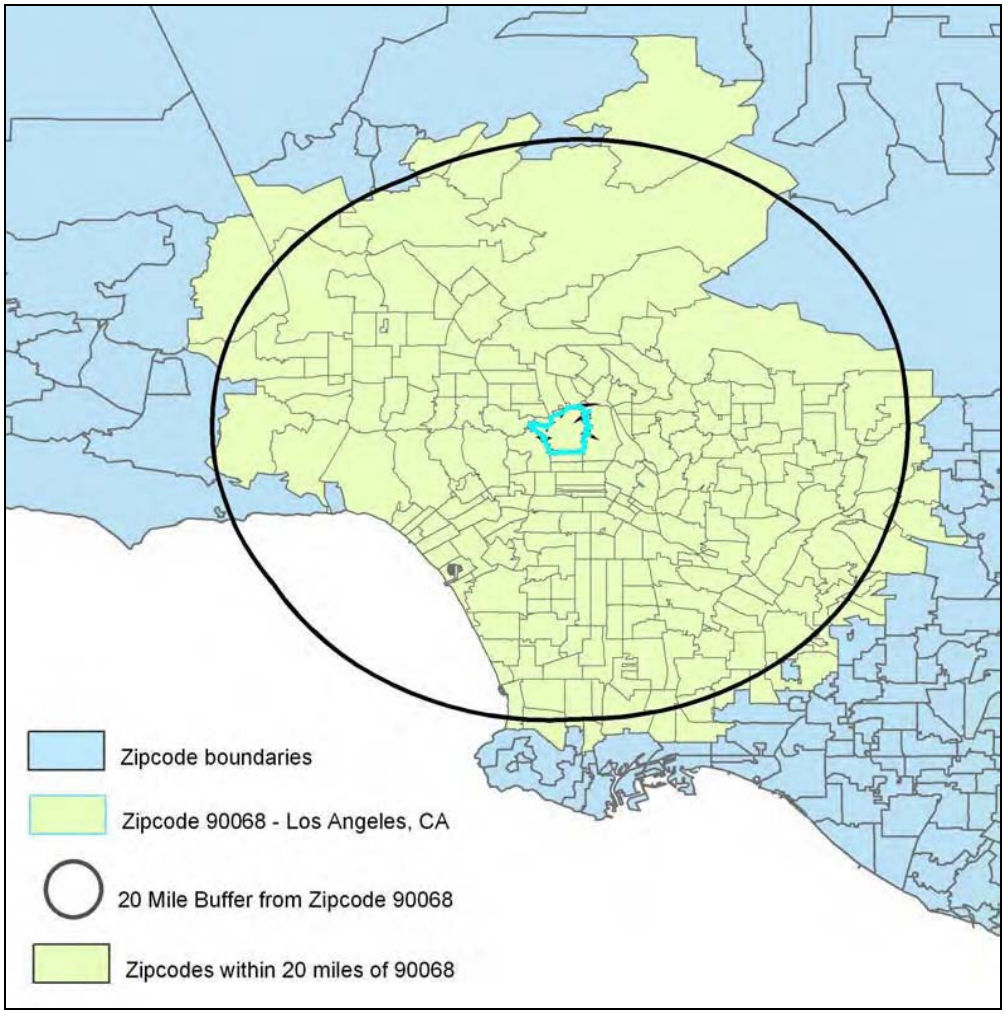
After filtering the vehicle owner database and the station manager/technician databases, we looked for areas of the state within which we could recruit the required numbers of individuals for each focus group. A reasonable distance to ask people to travel for a focus group (with an incentive in the $100 range) is about 20 miles or 30 minutes. After applying this distance criterion to the search, we quickly realized that the only area of the state with sufficient potential participants in a 20 mile radius of each other was the Los Angeles basin. After locating several possible focus group locations in the South Coast area, we settled upon a location in the Burbank/Hollywood area. The facility is run by Schlesinger Associates, a well-respected firm in marketing research and qualitative analysis. Their website is at www.schlesingerassociates.com.

The Schlesigner Associates facility is located in the 90068 zip code. ERG used geographical information software to identify zip codes within a 20-mile radius of the 90068 zip code. Figure 1 is a map of the applicable zip code boundaries. Any potential participant within these zip codes was a candidate for recruitment.

ERG developed scripts for our subcontractor to use in recruiting participants. The scripts provided a standardized check list for recruiters to help decrease misunderstandings during the process. Recruits who volunteered to participate were send a confirmation letter with information on the time and place of their focus group and whom they should contact with questions.

The groups in southern California were held at Schlesinger Associates. They are located in the Panasonic building on 3330 Cahuenga Boulevard West, in Los Angeles. This is across U.S. highway 101 from Universal City. All focus groups at this facility took place on July 24, 2007. Vehicle owners were interviewed at 8:00 am, high performing managers and technicians at 11 am, low performing managers and technicians were at 3:00 pm, and cited/revoked managers and technicians were at 6:00 pm.

Figure 1. Map of Zip Codes Participants Were Recruited From



Results

The first of the five focus groups was done in Sacramento with BAR personnel. The last four were all performed in southern California on July 24.

Recruiting Results

Recruiting for the BAR Personnel focus group was a special case of having BAR managers decide who they considered best for the focus group, having ERG review BAR suggestions, then having the BAR managers arrange for their personnel to participate in the focus group. No monetary incentives were offered for that focus group. Six personnel were suggested by BAR and agreed to by ERG. All six of those personnel participated in the focus group in Sacramento.

Recruiting for the vehicle owner and station manager/technician focus groups was a more normal type of focus group recruiting, in that the recruits were offered monetary incentives and were required to participate during their normal work day, but not necessarily with the cooperation of their employer. An added complication was that the recruiter had to overcome a level of suspicion as a 'representative' of the state. This suspicion is understandable considering the fact that these focus groups often targeted groups with a high likelihood of having 'skirted' the letter of Smog Check rules. For example, many of the vehicle owners had failed their Smog Check, then passes a later Smog Check (presumably after having the vehicle repaired), then gone on to fail a roadside inspection and many of the technicians were labeled as 'low performing' by BAR enforcement.

Table 1 summarizes recruiting results for all focus groups. The previously discussed results for the BAR focus group are on the top row. Results for the other groups are in the bottom 4 rows. All recruiting for the focus groups in Los Angeles was done by telephone. In the case of vehicle owners, ERG subcontractor SDV/ACCI searched for the phone numbers based upon names and addresses obtained from the DMV database. Of the 314 possible candidates within 20-miles of the facility, 65 valid phone numbers were found. While this was not the desired number of possible recruits (i.e., 80), it was sufficient to obtain commitments from 5 individuals to participate in the vehicle owner focus group. Unfortunately, only two of those individuals actually participated in the focus group at 8 am.

Similar results were seen for the manager/technician focus groups. Of the approximately 80 to 100 individuals recruited, between 6 and 8 volunteered to participate in each focus group. Interestingly, the volunteer rate seemed significantly higher for the groups labeled by BAR enforcement as 'lower performing.' This may indicate that the volunteer rate is influenced by the focus group's dissatisfaction level with the system. Unfortunately, as was the case with the vehicle owners, only two or three individuals actually participated in each focus group. Even though SDV/ACCI was authorized to call all afternoon volunteers on the morning of the focus group, and offer them a 50% increased incentive of $150, the participation rate did not rise for the later focus groups.

Table 1. Summary of Recruiting Results for All Focus Groups

Group	City	Date/Time	Within 20-mile Radius	Recruited	Volunteered	Participated	Final Incentive
BAR Personnel	Sacramento	Jun. 1 at 8:30 am	n/a	6	6	6	$0
Vehicle Owners	Los Angeles	Jul. 24 at 8 am	314	65	5	2	$100
High Performing	Los Angeles	Jul. 24 at 11 am	78	78	6	3	$100
Low Performing	Los Angeles	Jul. 24 at 3 pm	97	97	7	2	$150
Cited/Revoked	Los Angeles	Jul. 24 at 6 pm	99	84	8	2	$150

Focus Group Results

All focus groups were conducted at facilities expressly designed for that purpose. Each facility had a meeting room with a two-way mirror to an adjacent observation room, where expert observers took notes. All focus groups were recorded on DVD as well. First we discuss the recruiting results, then the focus group results.

Mr. Andrew Burnette of ERG and Brian Fowler, ERG's subcontracted through SDV/ACCI were present in the BAR personnel focus group session. Mr. Fowler facilitated the meeting and Mr. Burnette answered technical questions as needed. Observers from both ARB and BAR were present in the observation room. Only Mr. Fowler was present for the rest of the focus groups. Mr. Burnette observed all of these sessions

from the observation room. Some ARB and BAR personnel were also present during some of these focus groups.

The first focus group, with BAR personnel, produced the most findings, opinions, and suggestions. Not only was this group larger than the others, it also consisted only of professionals who were expert in their areas of the program. BAR personnel suggested several reasons why vehicles may legitimately pass a Smog Check inspection, then go on to fail a roadside inspection. The following bullets summarize these reasons.

- The roadside crew always uses a fan to help cool the vehicle but stations only use fans when the temperature is over 72F. Use of the fan can influence emissions.
- Being in the sun or fog may have an impact because ambient conditions influence the vehicle emissions. Temperatures change pretty drastically during the day in inspection lanes. These may be quite different than for the roadside systems.
- All roadside units use the ESP BAR97 system, and there are systematic differences between the BAR97 systems (ESP, Sun, Worldwide, etc.).
- Roadside equipment is better maintained that station equipment. For example, stations perform calibrations and leak checks about every three-days, but Roadside crews do them every day.
- Cutpoint changes may have occurred between the roadside inspection and the Smog Check inspection it is being compared to. It wouldn't be a fair comparison if vehicles are failed at roadside using a stricter standard than they were repaired to.
- Roadside vehicles are all being driven on surface streets. So vehicles that are mainly driven on the highway, which are in better shape, are not included as much in the roadside sample.

The BAR personnel further mentioned that, as compared to typical Smog Check technicians, there is a different level of competence and incentives in the roadside crew. Different fail rates are to be expected. Referee technicians have a level of competence similar to roadside crews, so referee stations probably have a fail rate much closer to that of roadside crews.

BAR personnel generally agreed that more could be done to improve the program. Their suggestions are summarized in Table 2.

The station manager and technician focus groups were also quite fruitful in providing suggestions and opinions for Smog Check. Although there was a discernable difference in the attitudes and experiences of these last three focus groups, their opinions and suggestions were strikingly similar. They are also summarized in Table 2.

The vehicle owner focus group was important mainly to give the customer's viewpoint and to add weight to some of the more important findings. Their suggestions are likewise summarized in Table 2.

Conclusions and Recommendations

All significant findings are listed in Table 2 at the end of the previous section. In this section we discuss what we consider the most important of those findings.

After considering the information gathered in these focus groups, ERG has several conclusions and recommendations for the Smog Check program. Most of these suggestions will implicitly require some further research, which should be designed after ARB and BAR have decided upon priorities for possible program changes.

Table 2. Summary of Focus Group Findings

Finding	BAR Personnel	Vehicle Owners	Managers & Techs	Notes
Cheap catalysts are common and cause temporary 'repairs'.	X	X	X	This was the most mentioned problem. $150 catalyst replacements are of low quality. A good quality catalyst replacement is about 10-times more expensive.
Technician certification and renewal should include hands-on diagnostic tests	X		X	Written tests allow incompetent technicians to be certified.
Attempted bribery is fairly common.	X	X	X	All who mentioned it said $100 to $150 is the going rate.
Vehicle owners cheat too, so enforcement should include them			X	Maybe this could include better public education.
Time of day (i.e., ambient conditions) influences vehicle emissions	X		X	Perhaps temperature correction factors should be incorporated.
If a vehicle fails at test-only, require a Smog Check immediately after repair at the repair shop.			X	The inspection in the VID will record the repair result and the shop, increase revenue to the repair shop, and allow free re-test at original inspection station (if desired). Or sometimes the state could reimburse this to get more post repair data.
Fast pass encourages skipping the visual and functional tests	X		X	When techs see a fast pass, they often assume the visual and functional are okay. It makes the test go faster.
CAP Program is not as well known as it should be		X	X	Example of low-income owner who gave up vehicle that could not pass. Now taking the bus (takes 3-times longer), and looking for another cheap car.
6-year exemption from Smog Check is too long	X		X	Some cars may be out of warranty by then.
Truck cutpoints are manipulated by entering the wrong GVWR	X		X	Not seen as a big problem, but frequent enough to be noticed.
Test-only stations get several directed (to test-only) vehicles each day. This causes tense situations.	X		X	Some how vehicle owners are not understanding they should go to test-only if directed. Causes them inconvenience and bad feelings about the program.
Low concentration calibration gas should be even lower now	X			Some cutpoints are now in the 50 ppm [HC?] range, which is much lower than the calibration range.
Inadequate preconditioning is a problem due to customer waiting	X			Pretty common to fail for NOx at station, then pass at Gold Shield (CAP).
idle	X			Some cars look like they will fail in manual mode (idle), but pass ASM.
There is significant pressure on techs to insepct quickly and pass vehicles.	X			Managers want 6 Smogs per hour and it is hard to tell owners they failed the inspection. Techs with higher fail rates are fired first.
Comprehensive 'end of warranty' inspection should be required for vehicles	X			Dealer/manufacturer should fix any warrantied items at end of warranty.
shops	X			
Tech training should emphasize diagnosis and ethics	X			This is in addition to the hands-on test mentioned above.
Service writers should be held accountable for fraud at their shop	X			This would encourage oversight of technicians
Better technicians should be rewarded somehow	X			Money or recocgnition of some kind would work.
A NOx 'hangup' test is needed because of lazy NOx electrochemical cells	X			This would allow lazy cells to come back to zero before the next test. This would be less important when the UV method replaces electrochemical method.
Cars could be given grades when they are certified. This might increase the value of low emitting used cars.	X			Cars with an 'A' would be more reliable, likely to pass, fuel efficient, etc.
Enforcement personnel would benefit from more time doing their Intranet research.	X			The intranet tools are valuable for finding 'bad players', but there is not enough research time available to effectively use them.
Enforcement personnel would benefit from more 'one-on-one' tech time during field audits. Some personnel felt VID data was not shared with enforcement well enough.	X			This will allow better communication/training with lower quality techs. One person felt that anayzer data was not readily available to enforcement.
Automatic consumer survey cards (post inspection) could help identify stations needing improvement.	X			This could be used to both get and give information. Were the told about CAP? Were they given a written estimate? A web based option could be offered.
Better repairs should be encouraged with monetary incentives. Or not.	X			One idea was to charge higher certificate fees to low performing stations. One person felt strongly that incentives are wrong. Techs should do their job right without new incentives.
1976 and older vehicles should be inspected at change of ownership.	X			This would encourage more rapid turn-over of older vehicles.

Inferior catalytic converters are a major cause of ineffective repairs:
The most important finding stems from a legitimate repair that should probably be disallowed in California. All groups agreed that low-cost catalytic converters are a prevalent repair item for failing vehicles. At about $100 to $150 installed, commonly used replacement catalytic converters cost as little as 10% of a high-quality 'OEM' catalytic converter. This cost difference is largely driven by the content of precious-metal catalysts that make the catalytic converter work. Participants with relevant technical expertise all agreed these catalytic converters are inferior and are a major cause of rapidly rising emissions after repair. *This finding supports the current efforts of ARB and BAR in determining the impact of disallowing the use of inferior catalytic converters.*

The fast-pass feature 'encourages' technicians to skip the visual and functional portions of the inspection:
When a vehicle 'fast-passes' the emissions portion of the inspection, the technician knows there will be little suspicion aroused if the vehicle passes the visual and functional portions of the inspection as well. Therefore, after a 'fast-pass' they feel safe skipping the visual and functional portions by entering a 'pass' or 'not applicable' response (as appropriate) when prompted by the analyzer software. These parts of the inspection are time-consuming and considered irrelevant by some technicians when the emissions are low enough to pass the test. *BAR should consider turning off the fast-pass feature for at least certain classes of vehicle (e.g., older vehicles with a high tendency to fail the visual or functional inspection). These vehicle classes could probably be identified from roadside and referee inspection records. [Would this change require a software modification?]*

The CAP program is not as well-known as it should be:
Both technicians and vehicle owners mentioned that the CAP program is not as well known as it should be. Managers and technicians agreed that the program is well-run and useful. Although most of them routinely mention the program to failing customers, they said most people were unaware of the program when they do mention it. One vehicle owner had a low-income friend who had given up her vehicle because she could not afford to repair it and was never aware of her option to apply for assistance through the CAP program. *BAR should consider ways to encourage all technicians to sell the CAP program. Perhaps a referral system could be set up where the referring technician receives discounts on professional expenses, profit-sharing with the station that performs the repairs, or some other pro-active incentive for referring vehicles that qualify and participate in the CAP program.*

An on-going consumer feedback/education program should be implemented:
BAR personnel felt that consumer feedback is a source of information that could be put to better use. Current feedback is complaint driven. A program that methodically encourages feedback, while providing education at the same time would help Enforcement target stations needing improvement and discover what parts of the program consumers are not sufficiently aware of. *BAR should consider a program that randomly solicits feedback by mail (consumers without access to the World Wide Web) and should encourage feedback via BAR's website on an electronic survey form.*

Appendix A

Scripted Questions for Vehicle Owner Focus Group

Discussion Guide for Motorist Focus Groups

Introduction

To begin, we want to be sure that everyone understands this is a confidential focus group. We emphasize this because we want everyone to speak freely regarding your previous experiences and your opinions. If it makes you more comfortable, feel free to attribute actions to a third, unnamed party. For example, you could say, "I know someone who did this," Instead of saying, "I did this."

Recent studies have shown that a large number of vehicles pass their Smog Check test and then fail a roadside test conducted immediately afterward. The group here this morning may include several people that have experienced this problem with their vehicles. Try to remember your last Smog Check. It should have been since October of last year. Try to remember if you failed or passed on the first attempt. It's not critical, but may be helpful in answering some of my questions this morning.

Based on your personal experience, we would like to investigate why so many vehicles certified by the Smog Check program subsequently fail a roadside test. This problem is particularly relevant as the State grapples with revising its plan to meet air quality standards.

To answer this question, we are looking for insight from people such as you, who are most likely to understand what is happening in the real world. Consequently, you may be able to help identify new, innovative ways to address these problems. Such insights are best discovered through an open, exploratory discussion.

Again, we encourage full participation from the group. Be assured that everyone's identity will be held confidential, and will not be provided released publicly to anyone.

I.

[The following questions may be asked of all motorists.]

1. Did you prepare for your initial test before going to the Smog Check station? How?
2. Did a Smog Check technician give your vehicle a preliminary inspection or test before performing the actual Smog Check test?
3. Did a Smog Check technician recommend any repairs or maintenance prior to your initial test? If so,
   - What repairs were recommended?
   - Did you make those repairs?
   - Did the technician recommend a specific type of repair station for the work?
4. How much money did you spend on repairs or maintenance prior to your initial inspection?

II.

[The following questions are for vehicles that failed their initial inspection].

5. After you failed the test, did station personnel provide you with adequate information on what to do to your vehicle before returning for a retest?
6. After your vehicle failed the test, which one of the following things did you do?
   - Took the vehicle to a professional mechanic to have it repaired
   - Repaired the vehicle yourself or had it repaired by a family member or friend
   - Figure out a way to pass the test without any repairs (including going to another station that would pass it).
   - Did nothing and:
     - sold or traded-in the vehicle
     - quit driving the vehicle
     - scrapped the vehicle
     - continued driving the vehicle without re-registering it
     - figured out a way to re-register the vehicle anyway
     - other
7. How much money did you spend, if any, on your vehicle to get it to pass the test?
8. Did the technician offer an option for "higher end" and "lower cost" parts?
   - If so, which did you choose?
   - Did he explain the advantages of high-end repairs?
   - Do you think the high-end repairs were a good idea?
   - What was the price difference?
9. What repairs, if any, were made to get your vehicle to pass the test?
   - If parts were purchased, were they new or aftermarket parts?

III.

[The following questions may be asked of all motorists.]

10. Do you have any ideas why your vehicle failed its roadside inspection so soon after receiving a Smog Check certificate?
    - Did you notice any change in vehicle performance between your Smog Check test and the roadside test? Please elaborate.
    - Did you have any additional work done on your vehicle between the Smog Check and roadside tests? If so, please describe.
11. We have heard of motorists making "temporary adjustments" to their vehicles in order to pass their Smog Check test. Do you believe this is feasible, and if so, how might this be done?
12. What other ways might motorists with high emitting vehicles obtain a passing Smog Check certificate?
    - How common are these approaches?

- How much do you think they cost (in terms of time and money)? [Ask about bribes and the required size of the bribe if it doesn't come up.]

13. Please tell me if you are very familiar, somewhat familiar, or not familiar with the following options for failing vehicles:
    - Waiver option
    - Consumer Assistance Program
14. Some people have told us that they have managed to avoid the vehicle emissions test requirements when they expected their vehicle to fail. Would you say this practice is common or uncommon in your area? If a motorist does not comply with the Smog Check requirements, how likely do you feel it is that they will get caught and fined:
    - extremely likely
    - very likely
    - somewhat likely
    - not very likely
    - not at all likely
15. What could be done to encourage motorists to have their vehicles fully repaired after they fail a vehicle emissions test (i.e., not just enough to pass)?
16. What could be done to encourage motorists to fully comply with the emissions testing program?

Appendix B

Scripted Questions for Station Manager, Technician, and BAR Personnel Focus Groups

Discussion Guide for Focus Groups of Technicians, Station Owners/Managers, and BAR Personnel

Introduction (technicians/station owners/enforcement personnel)

Recent analyses performed under contract to both California BAR and the California ARB show that too many of the vehicles that were certified after having failed an initial smog inspection subsequently fail a roadside test conducted immediately afterward. In addition, too many of the initially passing vehicles were in a high-emitting condition at the time they were granted a certificate. Analysis also shows that this high re-failure rate is not a consequence of rapid deterioration of emissions control equipment. Instead, it appears that many of the vehicles may not have been in a passing condition at the time of certification. This is the problem we want to investigate today: Why are so many vehicles certified by Smog Check technicians failing roadside tests immediately after passing their Smog Check test? This problem is particularly relevant as the State grapples with revising its plan to meet its air quality standards.

Understanding the Issues (both groups)

So how do we improve the rate at which vehicles are properly tested and repaired prior to certification? To answer this question, we are looking for insight from people such as you, who are most likely to understand what is really happening on the ground.

Technicians/Station Owners[15]

As agents licensed through the Bureau, technicians are the gatekeepers of the Smog Check certification. As such, they bear particular responsibility for ensuring that only compliant vehicles are certified. Technicians and station operators are well positioned to understand both the motivations for improper testing, repair, and for motorist noncompliance, as well as the specific actions that lead to the high re-fail rates observed. In other words, you understand the "How" and the "Why" associated with this problem better than anyone else. Consequently, you may be able to help identify new, innovative ways to address these problems. Such insights are best discovered through an open, exploratory discussion.

We encourage full participation from the group. Be assured that the identity of all respondents will be held confidential, and will not be provided released publicly to anyone.

I.

Let's begin by discussing how high emitters may be *legitimately* slipping through the Smog Check test.

[15] The wording in this section should be altered for the de-certified owner/technician group to reflect past-tense where appropriate.

1. *Is it common for vehicles to fail, get retested immediately without additional preconditioning, and then pass without any adjustments or repairs? Do you think the change from fail to pass is the result of the analyzer or vehicle performance? Why?*
2. *Do you know any legitimate reasons a vehicle would pass when it normally would fail the test?* …[If no one brings them up, here are some suggestions…]
   a. *Technicians preconditioning vehicles differently than others? What could be done to improve the consistency of preconditioning?*
   b. *Motorists fail at one shop and then go to another to get a second opinion?*
   c. *Inconsistent results between stations? What are the likely causes of the inconsistencies?*

II.

I'd like your opinions on "gaming" the test process

- *How common is it?* [If they say it doesn't happen, ask the next question.]
- *Is it technically feasible?*

Now I'm going to read a list of possible ways of "gaming" the test process. [Read the following together in groups, allowing the participants to respond to each group, then proceed to the next. Put each group on white board or easel for reference. Run through these quickly.]

3. *Altering Emission Reading/Data Stream*
   - Clean piping
   - Clean plug/scan (OBD)
   - Dilute exhaust sample

4. *Temporary Vehicle Modifications*
   - Retard timing
   - Induce vacuum leak
   - Alter idle speed (TSI only)
   - Alter engine load (A/C, lights on…)

5. Fraudulent Test Sequence/Execution
   - Incomplete/abort emissions test
   - Incomplete visual/functional
   - Gear Shifting

6. *Altered Preconditioning*
   - Over condition vehicle
   - "I/M lotto"

7. *VID Manipulation*
   - Change vehicle description to select less stringent cutpoints
   - Select different vehicle or fuel type

- Select older model year
- ASM to TSI
- Incorrect entry to select default test settings

8. *Test Equipment Manipulation*
   - Analyzer tampering
   - Dirty "zero air" to set false zero

9. *Has anything else come to mind as we discussed these?*

III.

Next, let's discuss the possible role of repairs.

10. *Do most consumers generally authorize the repairs you suggest? If not, why not?*

11. *To what extent do technicians feel pressured to perform inexpensive repairs that will cause the vehicle to pass the retest (but not necessarily fix the underlying problem)? Why?*
    - *Pressure from motorists*
    - *Financial and/or time pressure*

12. *Are there drawbacks to ensuring vehicles are completely repaired prior to being granted a certificate? What are they?*

IV.

Now, I'd like to discuss how the motorists themselves may be influencing test results.

13. *Is it common for motorists to offer bribes to pass their vehicle? For how much?*

14. *Do you believe that motorists know how to find shops that will certify their vehicle, regardless of condition?*

15. *Do you believe replacement part quality is a significant factor in determining retest results? If so, for which parts?*

16. *Do repairs by unlicensed stations and/or unqualified technicians substantially impact repair quality?*

17. *What other means do motorists use to obtain a certification for a high-emitting vehicle, or otherwise avoid program requirements?*

V.

I'd like to conclude by discussing how the Smog Check program could be made more effective at ensuring proper testing and repair of high emitting vehicles.

18. *For a "typical" gross emitter, please estimate the repair cost at which motorists would prefer to simply scrap their vehicles.*

19. *Are consumers generally aware of the options available under the CAP program? Is it effective?*

20. *Are there other ways BAR, technicians, or stations can improve motorist compliance with the Smog Check program?*

21. *Are the current audit and enforcement policies effective at ensuring high station performance? If not, what do you think would make them more effective?*

22. *What could BAR do to help stations identify more polluting vehicles? (Training? Incentives?)*

23. *What could BAR do to help stations repair more polluting vehicles? (Training? Incentives?)*

BAR Enforcement Staff

As representatives of the Bureau, the audit and enforcement staff provides the foundation for ensuring the integrity and effectiveness of the Smog Check certification process. As such, you are well positioned to understand both the motivations for improper testing, repair, and motorist non-compliance, as well as the specific actions that lead to the high re-fail rates observed. In other words, you understand the "How " and the "Why" associated with this problem as well as anyone. Consequently, you may be able to help identify new, innovative ways to address these problems. Such insights are best discovered through an open, exploratory discussion.

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V.

I'd like to conclude by discussing how the Smog Check program could be made more effective at ensuring proper testing and repair of high emitting vehicles.

17. *Are there other ways BAR, technicians, or stations can improve motorist compliance with the Smog Check program?*

18. *Are the current audit and enforcement policies effective at ensuring high station performance? If not, what do you think would make them more effective?*

19. *What could BAR do to help stations identify more polluting vehicles? (Training? Incentives?)*

20. *What could BAR do to help stations repair more polluting vehicles? (Training? Incentives?)*

Attachment E

Comparative Analysis of Current Training and Proposed Training Initiatives for Smog Check Technicians

Attachment E

2009

COMPARATIVE ANALYSIS OF CURRENT TRAINING AND PROPOSED TRAINING INITIATIVES FOR SMOG CHECK TECHNICIANS

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FINAL REPORT
Revised 2/6/2009

EXECUTIVE SUMMARY

The Bureau of Automotive Repair (BAR) is at a crossroads in its approach to Smog Check technician training. BAR recognized that its curriculum and training materials are outdated. BAR also recognized concerns with regard to the effectiveness and durability of the repairs performed by its technicians. This report provides an independent assessment of BAR's training strategies, processes and procedures and recommendations for sustainable options that would better meet its training needs. Data were gathered from interviews, survey questionnaires and workshops. BAR provided archival data that included enrollment statistics, candidate pass/fail results, and recent proposals to restructure the training program.

The principal findings and recommendations are detailed below.

1. *Current licensing strategy*. Training and licensing requirements for technicians who only conduct inspections are excessive and should not include diagnosis and repair. Highly-trained/experienced technicians should have different pathways to licensure than entry-level technicians. The Basic Area Technician (EB) license should be phased out because very few technicians took the examination and very few hold the EB license.

Recommendations:

- Establish sequentially progressive training to accommodate different experience levels (inexperienced vs. experienced).
- Phase out the EB license. Require existing EB technicians to successfully complete additional coursework prior to accepting positions in Enhanced Areas.
- Create a two-tiered system for licensing technicians who conduct inspections vs. technicians who perform diagnosis and repair.
- Restructure course content into a modular format to allow flexibility in content and course offerings.
- Require current ASE A6, A8, L1 and/or driveability certifications for biennial renewal of technicians who perform diagnosis and repair.

2. *Current curriculum*. Current curriculum and course hours need to be overhauled and course materials should be updated and better integrated.

Recommendations:

- Incorporate more hands-on exercises that involve commonly encountered inspection and diagnostic situations.
- Develop a pass/fail hands-on "end-of-course" exercise to be administered as part of the final examination.
- Restructure courses into a modular format to ease the process of adding new program requirements.

- Establish training modules for licensed technicians who conduct inspections vs. technicians who perform diagnosis and repair, including a hands-on examination of skills.
- Establish training modules to facilitate different types of inspection including OBD II only, diesel, tailpipe.

3. *School/instructor performance*. Initial pass rates on the BAR licensing examination for training institutions vary significantly from institution to institution. Students who received training from California community colleges had the highest pass rate (75%) followed by private institutions (58%), and, Regional Opportunity Programs (ROP)/high schools/adult education programs (55%).

Recommendations:
- Refine selection criteria and procedures for certifying instructors.
- Develop criteria and procedures to audit training institutions and identify underachieving instructors.
- Develop procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

4. *Role of BAR, instructors and SMEs in course content, curriculum and textbook approval*. The existing process is untenable because BAR performs a comprehensive editorial review rather than a "go/no-go" process. For example, a book is reviewed for technical content and editorial integrity such that BAR staff are required to provide edits for errors in grammar, spelling and punctuation as well as assist the authors in identifying weaknesses and improving the quality and coverage of the book, e.g., relocating sentences, paragraphs, or sections within a document.

   The majority of instructors indicated that BAR should work with outside expertise, i.e., subject matter experts (SMEs) paid by the state or committees of educators, to identify course content, course curriculum, and textbook/resource material approval.

Recommendations:
- Under BAR's guidance and direction, contract with a single vendor to guide committees of SMEs to develop curriculum, curriculum standards, selection procedures for instructors and outcome measures for students and training institutions.
- Under BAR's guidance and direction, contract with a single vendor to provide course curriculum, textbooks and course materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.
- Contract with a single vendor to design a hands-on "end-of-course examination" that meets BAR's specifications.
- Enhance examination security procedures for vendors and SMEs.

In summary, BAR should effect significant changes in its current licensing strategy and training program. BAR's role in the process should be an authoritative one that

approves/disapproves processes, procedures, and materials developed by knowledgeable vendors.

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SECTION 1: INTRODUCTION

BACKGROUND

The Bureau of Automotive Repair (BAR) is at a crossroads in its approach to Smog Check technician training. Important curriculum and training materials are outdated and need to be revised. There is a great deal of concern generated in government, industry, and consumer forums with respect to repair effectiveness and durability, and, consequently, technician training. BAR's Ad Hoc Educational Advisory Committee (AHEAC) and other educators have raised concerns that today's students lack an understanding of the use of hand tools, electrical theory, and/or engine operation basics. Furthermore, BAR recognizes that the current processes for developing training materials and selecting textbooks is labor intensive and may be vulnerable to conflict of interest.

BAR is responsible for the administration of California's vehicle inspection and maintenance program, known as "Smog Check." The program licenses the technicians who perform the vehicle inspections and/or vehicle repairs as well as the 8,000 stations where the inspections are performed. The program also certifies the instructors who teach BAR certified training courses, BAR update training courses, and Citation courses for technicians who have received a citation from BAR. The goal of the Smog Check program is to ensure that in-use vehicles stay clean as they age.

To successfully repair Smog Check failures, technicians must have the ability to analyze the results and determine the correct approach for diagnosis of complex, integrated vehicle emissions control systems. As technology advances with each new vehicle model year, vehicle systems become more complex and place more demands on training of these technicians.

BAR's Standards and Training Unit (part of its Technical Services Branch) is responsible for establishing training requirements for initial Smog Check licensees as well as update training for technicians who renew their licenses. The Standards and Training Unit also establishes the minimum licensing requirements and develops the licensing examinations.

In addition to course requirements, BAR develops textbook specifications, designs, evaluates and approves curricula and course materials, and, certifies schools and instructors for qualifying Smog Check program-related training courses taught in California. BAR inspects the schools periodically to determine if they have the required tools and equipment compliance.

TRAINING IN OTHER JURISDICTIONS

The training requirements of 10 other jurisdictions are presented in Table 1.

Table 1 – Training requirements of other jurisdictions

Delaware	• "Test-out" = L1 certification, minimum score of 75% on examination, 1 training module for program specific information, or, 60 or more hours of training, minimum score of 75% on examination, one training module for program specific information
Illinois	• Three contracted instructors leading seven free diagnostic and repair seminars weekday evenings (6 to 10 pm)
Maryland	• Two contracted university instructors leading a scan-tool/oscilloscope diagnostic seminar in morning, afternoon and evening courses • Licensure requires A6, A8, L1 certificates and five years experience, or, four years experience and two years related training.
Nevada	• Certificate from gas analyzer manufacturer, training course, written examination, hands-on examination • For repairs, L1 certification
New Jersey	• A6, A8, L1 certification and training
New Mexico	• Pretest to establish general automotive repair competency, three-day training (two-day classroom, one-day hands-on emission testing on consumer volunteer vehicles at no cost to the consumer) • Annual renewal requires four-hour update training
Ohio	• EDGE or Ohio 1 training (40 hrs @ $695), A6 and A8 certification • Voluntary training available – Mode 6 ($95), NOx ($35), and OBD II ($35).
Pennsylvania	• Aspire training for initial and renewal applicants plus examination
Virginia	• Pass a training course or L-1 certification
Washington	• A1, A6, A8 certification, examination, training

ISSUES AND CONCERNS

APPROPRIATENESS OF CURRENT LICENSING STRATEGY

Smog Check technicians perform a variety of activities with corresponding skill sets. Many of the activities require low to moderate technical skills. Since most vehicles pass, the majority of Smog Check activities relate to vehicle testing. The current requirements for Smog Check technicians (initial training, update training, licensing examination, etc.) are, for all practical purposes, a "one size fits all" solution. The current strategy conflicts with the actual knowledge skills and abilities needed to perform various Smog Check activities in different practice settings.

BAR's current training strategy requires all technicians to complete emissions-related courses and pass a licensing examination that includes questions on diagnosing and repairing vehicles. However, some stations and technicians conduct Smog Check testing only and do not perform diagnosis or repair vehicles. Moreover, most California automotive repair dealers (ARDs), who perform similar types of diagnostics and repairs, do not require formal Smog Check training or the Smog Check technician license.

Current data indicate that California has approximately 35,000 registered ARDs, with the estimated number of unregulated technicians exceeding 100,000. About 7,600 of the ARDs are Smog Check stations and about 1,800 of the 7,600 are test-only stations, which are prohibited by law from performing repairs. Other studies suggest that large portions of the failed vehicles are repaired at unlicensed ARDs. It appears that a large percentage of the emissions-related repairs and maintenance that occur between inspections are performed at non-licensed ARDs.

HIGH COST OF SMOG CHECK INSPECTIONS IN CALIFORNIA

California has the highest Smog Check inspection costs in the nation. The average cost of a Smog Check inspection in California is approximately $49 plus $8.25 for the Smog Check certificate. The costs of Smog Check testing are high because technicians are required to possess the skills to diagnose and repair vehicles. Yet there are many settings in which technicians require a lower level of skill to conduct inspections. Approximately 60% of all inspections are conducted at stations that do not perform repairs. There are repair entries for only about 1/4 of vehicles that fail Smog Check. This suggests that many motorists are choosing to have repairs performed by technicians/facilities that are not licensed by BAR.

As seen in Table 1, the costs in California are significantly higher than the national average of $28.20. It should be noted that these states have programs that are smaller and less complex.

Table 2 – Number and cost of annual tests in I/M programs[1]

State	***Annual number of tests conducted***	***Fee***
Alaska, Anchorage	50,000	$45
Alaska, Fairbanks	25,000	$33
Arizona, Phoenix	735,000	$28
Arizona, Tucson	344,000	$12
California	9,200,000	$49
Colorado	1,192,500	$25
Connecticut	1,050,000	$20
Delaware	180,000	$20
District of Columbia	120,000	$20

[1] Data obtained from "Transitioning I/M: Options for inspection and maintenance in the OBD dominated fleet" written by the U.S. Environmental Protection Agency (2008).

State	***Annual number of tests conducted***	***Fee***
Georgia	2,200,000	$25
Idaho	225,000	$15
Illinois	2,900,000	$20
Indiana	250,000	$20
Louisiana	400,000	$10
Maine	200,000	$13
Maryland	1,600,000	$14
Massachusetts	2,100,000	$29
Missouri	600,000	$24
Nevada	1,200,000	$36
New Hampshire	1,200,000	$20
New Jersey	3,000,000	$36
New Mexico	220,000	$20
New York	5,000,000	$27
New York Upstate	5,000,000	$11
North Carolina	2,800,000	$30
Ohio	1,000,000	$20
Oregon	562,500	$21
Pennsylvania	5,400,000	$35
Rhode Island	330,000	$47
Tennessee, Memphis	450,000	$25
Tennessee, Middle	1,170,000	$10
Texas, Dallas-Ft Worth	2,500,000	$27
Texas, Houston	2,500,000	$27
Texas, El Paso	350,000	$14
Texas, Travis, Williamson	750,000	$14
Utah, Davis	160,000	$25
Utah, Weber	100,000	$25
Utah, Utah Co.	216,000	$30
Utah, Salt Lake	536,000	$25
Vermont	550,000	$22
Virginia	700,000	$28
Washington	1,100,000	$15
Wisconsin	750,000	$20
Total tests conducted	**60,916,000**	**$28.20**

TRANSITION TOWARDS OBD II BASED INSPECTIONS

A recent report issued by the US Environmental Protection Agency (USEPA) indicates that IM programs are transitioning towards OBD II based inspections. The report cites that of emission testing performed during CY 2007, 25.3% of the vehicles tested at a test and repair facility failed as compared with 59% of the vehicles tested at a test only facility. These inspections are simpler, require less complex test equipment, etc., which will likely require more inspection technicians, who will not need to be trained in

complex diagnostic and repair procedures. Currently, about 2/3 of Smog Check tests are performed on OBD II equipped vehicles in California.

LIMITATIONS OF LICENSING EXAMINATION

The primary focus of the Smog Check Licensing examination is on low skill functions because these functions represent the majority of tasks and the majority of the questions on the examination. This results in the possibility that a technician may fail all diagnostic and repair related questions but still pass the examination.

Previous program evaluations of Smog Check program performance concluded that Smog Check inspections are failing to identify many high-emitting vehicles. Previous studies concluded that between 37% to 48% of the vehicles that should fail Smog Check have been certified even though they should have failed. Data from these reports indicate that many vehicles are not being effectively tested and repaired.

It is important to note that many tasks, requiring a low level of skill, are automated functions controlled by analyzer or BAR's data management system, while other tasks may be performed by individuals other than the technician. For example, in many businesses, the technician may not be the individual who communicates with the motorist but is required to have the information. The person who communicates with the motorist may be a service writer, who is not required to have any training, certification, or license.

TRAINING INSTITUTIONS DO NOT MEET MINIMUM STANDARDS

BAR's recent evaluation of school enrollment and pass/fail data implies that ineffective instructors/schools accept students into their programs who should not be admitted into the Smog Check training program, and pass students who do not meet minimum standards. It might be beneficial for measuring school performance if there were an independent assessment of student qualifications, e.g., knowledge, skills, and experience and an assessment, including hands-on demonstrations, following the completion of the BAR courses to ensure students are actually meeting minimum standards.

Currently, course examinations have been administered by the schools for many years without safeguards for examination security, e.g., backup examinations, schedule for periodic replacement. BAR does not have resources to develop and maintain credible examinations for schools. Schools/instructors may have a conflict of interest in administering examinations, given that they may feel obligated to issue a certificate to students who paid for the course. As a result, some schools have 100% of their students pass the course, while the overwhelming majority fail the BAR examination. BAR needs to ensure that schools are administering "end-of-course" examinations under secure conditions.

PRESSURE TO PRODUCE JOURNEY LEVEL TECHNICIANS

The pressure applied to BAR certified instructors to produce journey level Smog Check technicians originates from statutes that mandate only licensed Smog Check technicians conduct inspections and perform repairs. The statutes, however, do not provide for an apprenticeship or mandatory mentorship. If such a program were in place, technicians could obtain the necessary hands-on job skills to perform the job.

DIVERSITY OF VEHICLES, MODELS, CHANGES IN CONFIGURATION

Today's vehicles originate from a wide array of countries and there are many models produced by each manufacturer. There are configuration changes within model years of vehicles that require substantial training and on-the-job experience to establish competence to service a single generation of vehicles produced by a single manufacturer. Therefore, the challenge for today's technician is to understand configuration changes for models produced by multiple manufacturers.

Training required to provide competent inspection, diagnosis and repair services to such a diversity of vehicles may not be a reasonable expectation. The automotive repair training industry can only reasonably produce entry-level technicians, as opposed to journey level technicians, because California law does not mandate an apprenticeship or work experience under the tutelage of a mentor for newly licensed Smog Check technicians. Training institutions and instructors have the onus to produce journey level Smog Check technicians through training alone.

LACK OF UNIFORM STANDARDS FOR CERTIFIED INSTRUCTORS

Current standards used by BAR and private training institutions are insufficient for program needs. California code does not require automotive instructors to possess a college degree nor vocational education certificate. Community colleges state that adjunct faculty "should" have a minimum of an associate (AS) degree and six years of industry experience. Prior to the sunset of the Bureau for Private Postsecondary and Vocational Education (BPPVE), the minimum requirements for instructors employed by private institutions was "the possession of a credential generally recognized in the field of instruction." This standard is ambiguous and subject to interpretation, and could allow for certifications that are not sufficient relative to the level of competence necessary for instructors teaching subjects affecting public health. Since BPPVE was sunset, there is no enforcement of these requirements.

Currently, BAR requires prospective instructors to:

- Be ASE certified in electrical/electronics systems (A6), engine performance (A8) and advanced engine performance (L1),
- Be licensed by BAR as a Smog Check technician,
- Attend a 32-hour training session in instructional techniques taught by BAR staff, and,

- Receive a passing evaluation of a live training demonstration where the prospective instructor delivers a training module on a subject selected from a menu of subjects.

This process relies on ASE certification and BAR licensure to establish automotive technical expertise. Currently, there is a 60% failure rate of instructor candidates. The primary cause of failure is a lack of technical expertise.

AUDIT PROCESS FOR TRAINING INSTITUTIONS

California Code of Regulations (CCR) 3340.32 lists requirements to license training institutions. Each training institution is required to provide a list of equipment, allowing BAR staff access to facilities and records for inspection; and, to follow BAR recommendations to change methods of instruction and administration of examinations. Audits should be conducted to verify requirements related to instructor quality, course length, materials use and availability, lesson plan, mandated laboratory demonstrations, exercises, examinations, final examination security procedures, and required equipment. The current auditing process would likely be resource intensive because of class length, required expertise of auditors, geographic spread of institutions, and existing methods to conduct the audit.

PURPOSE OF THE STUDY

The purpose of the study was to provide an independent assessment of current and proposed training strategies in order to identify options that will better meet its training needs.

SECTION 2: RESEARCH STRATEGY

GENERAL APPROACH

In order for the study to be thorough and objective, Comira gathered information about BAR's technician training program from multiple sources: BAR staff, certified instructors at BAR certified training programs, persons who employed Smog Check technicians (station owners/supervisors of private fleets), and practicing Smog Check technicians in the field to gain an understanding of the industry.

UTILIZATION OF EXPERTS

Throughout the project, Comira consulted with BAR staff familiar with Smog Check technician training, educators at private and public BAR certified training programs, and licensed Smog Check Technicians to obtain information about BAR's technician training program.

APPLICABLE PSYCHOMETRIC STANDARDS

The Standards for Educational and Psychological Testing (1999) set forth by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education serve as the standards for evaluating of all aspects of credentialing, including professional and occupational credentialing. The Standards are used by the measurement profession as the psychometric standards for validating all examinations, including licensing and certification examinations. The Standards use the term "test" broadly and include credentialing procedures as well as actual tests.

Therefore, Standards 14.8, 14.10, and 14.14 apply directly to the foundation of the BAR's training program as well as all procedures and examinations.

Standard 14.8 states:

"Evidence of validity based on test content requires a thorough and explicit definition of the content domain of interest. For selection, classification, and promotion, the characterization of the domain should be based on a job analysis (p. 160)."

> Application to BAR's training program. Subject matter areas covered in the examination must be based on the results of an occupational (job) analysis of current practice. The results of the job analysis also apply to the rationale for including specific topics in training courses prior to and after licensure.

Standard 14.10 states:

"When evidence of validity based on test content is presented, the rationale for defining and describing a specific job content domain in a particular way (e.g., in terms of tasks to be performed or knowledge, skills, abilities or other personal characteristics) should be stated clearly (p. 160)."

> Application to BAR's training program. The rationale for candidate qualifications to enter the training program (experience and education) and the rationale for teaching specific subject matter in training courses must be based on sound validity evidence from occupational (job) analysis and from data obtained from subject matter experts.

Standard 14.14 states:

"The content domain to be covered by a credentialing test should be defined clearly and justified in terms of the importance of the content for credential-worthy performance in an occupation or profession. A rationale should be provided to support the claim that the knowledge or skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purpose for which the licensing or certification program was instituted (p. 161)."

> Application to BAR's training program. Subject matter covered in the examination should be covered in proportion to importance to practice (percentage of questions). Such proportions are obtained directly from the results of an occupational (job) analysis. Since the purpose of the examination is to identify candidates who possess the minimum training and education, the subject matter covered on the examination must be relevant to actual practice.

Standards 3.15, 3.22 and 3.23 apply directly to performance examinations.

Standard 3.15 states:

"When using a standardized testing format to collect structured behavior samples, the domain test design, test specifications and materials should be document as for any other test. Such documentation should include a clear definition of the behavior expected of the test takers, the nature of the expected responses, and any materials or directions that are necessary to carry out the testing (p. 46)."

> Application to BAR's training program. When designing performance examinations, e.g., hands-on exercises, the examination should be designed such that test takers are required to demonstrate those skills in settings that closely resemble real-life settings. The tasks in the performance examination as well as the scoring criteria should be clearly defined and documented.

Standard 3.22 states:

"Procedures for scoring, and if relevant, scoring criteria should be presented by the test developer in sufficient detail and clarity to maximize the accuracy of scoring. Instructions for using rating scales or for deriving scores obtained by coding, scaling or classifying constructed responses should be clear. This is especially critical if tests can be scored locally (p. 47)."

> Application to BAR's training program. When designing standardized scoring criteria for performance examinations, the criteria should be defined in sufficient detail as to maximize reliability of ratings for all examiners.

Standard 3.23 states:

"The process for selecting, training, and qualifying scorers should be documented by the test developer. The training materials, such as the scoring rubrics and examples of test takers' responses that illustrate the levels on the score scale and the procedures for training scorers should result in a degree of agreement among scorers that allow for the score to be interpreted as originally intended by the test developer. Scorer reliability and potential drift over time in raters' scoring standards should be evaluated and reported by the person(s) responsible for conducting the training session (p. 47-48)."

> Application to BAR's training program. There should be formal training for all examiners so that the candidates' responses are scored according to the same standards. Scorer reliability should be monitored regularly to ensure candidates receive the same examination experience.

JOB COMPONENT APPROACH

A job component approach was used to examine the Smog Check program. The approach is predicated on the assumption that any given job component or activity occurring in substantially the same form in different jobs would have the same requirements (McCormick, 1959; McCormick, 1976, p. 689). The approach requires justification of the use of a selection procedure based on demonstrated validity of inferences from one or more domains of work (job components). Components of the job are identified and their interrelationships are established. The idea is to demonstrate evidence for generalized validity of inferences based on sources of competencies and then use subsets of the sources for credentialing persons in the new situation.

Job component validation was selected for this study because its approach is best suited for situations in which undue dependence on subjective evaluations should be avoided and it is not possible to identify predictors for statistical evaluation (McCormick, 1976).

FRAMEWORK FOR JOB COMPONENT APPROACH

The job components and their interrelationships form the basis of a nomological network. Here, the nomological network maps the relevant competencies, required competencies, and acquired competencies, and the interrelationships among and between them (Cronbach & Meehl, 1955).

In this approach, the framework can be conceptualized as two intersecting circles in which there is a "person" side of the equation and a "job" side of the equation.

The "person" side of the equation involves competencies that candidates would have acquired prior to licensure:

- Coursework and training in Smog Check inspections
- Training and experience required for technician licensure
- ASE certification

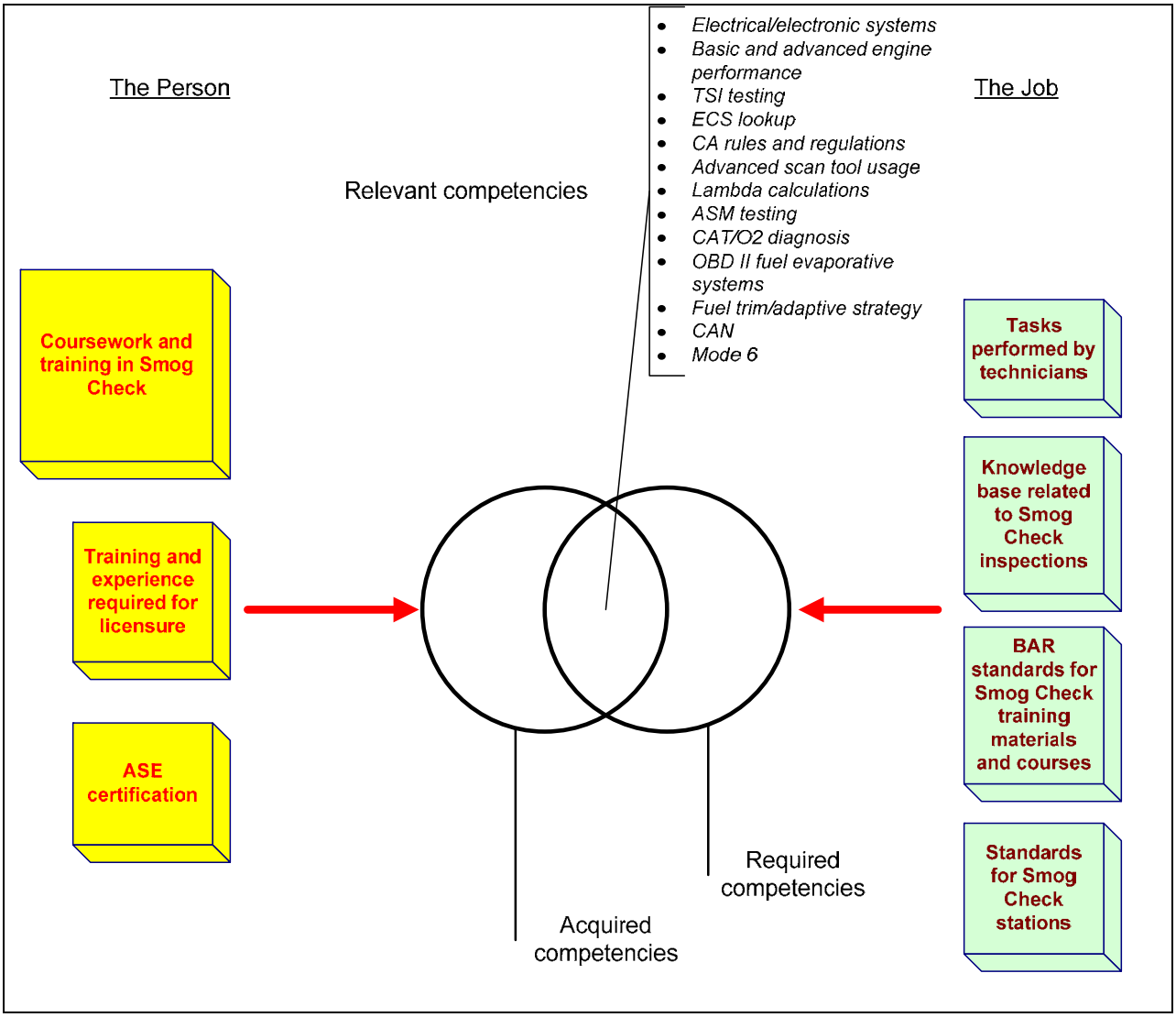
The "job" side of the equation includes what competencies are required to perform Smog Check inspections:

- Tasks performed by Smog Check technicians
- Knowledge base to perform Smog Check inspections
- BAR standards for Smog Check training courses and materials
- BAR standards for Smog Check stations

The person (acquired) and job (required) frameworks of the competencies in Smog Check training are illustrated in Figure 1.

Given this framework, we conceptualized the relevant competencies for performing Smog Check inspections to be the intersection of the acquired and required competencies. The implication is that the competencies of interest (Smog Check training strategies) are related to multiple dimensions that involve technician education and training, and, tasks performed and knowledge used on the job.

Figure 1 – Theoretical framework for Smog Check training



DATA SOURCES

As highlighted in the theoretical model in Figure 1, there were several types of data necessary to conduct the independent assessment of BAR's current training program.

SITE VISITS

Comira toured Smog Check training institutions (community colleges and private facilities) and Smog Check stations to solicit information about Smog Check equipment, inspections and technician knowledge.

INTERVIEWS

Instructors at community colleges and private training facilities were interviewed to solicit information regarding how training courses and hands-on exercises are implemented. Comira solicited information regarding students who took Smog Check training courses, how Smog Check materials were integrated into the curriculum, and issues related to student preparedness for working in the industry upon graduation.

2006 OCCUPATIONAL ANALYSIS

The job tasks in the 2006 occupational analysis were evaluated to determine if there were tasks that were specific to technicians who work in test-only stations.

WORKSHOPS

Workshop #1: A focus group of educators and technician-owners was convened to discuss the relationship of training to technician job performance. Comira solicited input from educators and technician-owners with regard to effectiveness of the Smog Check training program, Smog Check course content, course formats (lecture, hands-on exercises), strengths and weaknesses of technician training, challenges faced by instructors, and suggestions for improving course curriculum.

Workshop #2. A focus group of subject matter experts, including educators and BAR staff, was convened to identify the tasks and knowledge that entry-level Smog Check technicians were expected to know at the time of licensure. The BAR staff had extensive experience in Smog Check Program curriculum and enforcement issues related to Smog Check technicians. The focus group re-evaluated and refined the task and knowledge statements derived in a 2006 occupational analysis of Smog Check technician practice. The goal was to eliminate redundancies in the statements and refine the wording so that the job tasks and knowledge reflected entry-level practice of Smog Check technicians. In essence, the panel performed a "tabletop" (focus group method) occupational analysis to identify critical job tasks and knowledge base necessary to perform the duties of Smog Check technicians.

There were two purposes for conducting the tabletop occupational analysis:

- The first purpose was to validate job content and ensure that training reflects when competence in specific tasks was acquired during industry experience or from required coursework prior to licensure and when competence in specific tasks was acquired during industry experience or from update training after licensure. The tasks were used as the foundation of a needs analysis questionnaire.

- The second purpose was to validate the knowledge necessary to perform job tasks.

SURVEY QUESTIONNAIRES

Comira conducted four surveys of relevant stakeholders (instructors, technicians, station owners/supervisors) and reviewed BAR's Vendor Specifications for Bureau Training Program to obtain the desired information.

Survey #1: Smog Check Program Training Survey for BAR certified instructors. Approximately 300 instructors were notified by email to access the survey on Comira's online survey system. Once on the Comira website, they were instructed to obtain a unique username and password, and complete the survey. The instructors' usernames and passwords were linked to each instructor's email address and could not be used after the respondent submitted his completed survey.

In this survey, instructors were asked questions about their teaching experience, work setting, supplemental training taken, their views regarding current curriculum, areas for which students needed in-depth training, obstacles to teaching, and actions that BAR could take regarding the training program and course content. The full text of the questions and a summary of the group data are presented in Appendix A.

Survey #2: Smog Check Program Training Survey for new Smog Check technicians. The technician survey was sent by mail to 1,704 licensed technicians who had up to 2 years of licensed experience. The technicians were instructed to complete the survey and return it to Comira's Folsom office in a stamped, self-addressed envelope.

In this survey, technicians were asked about their training institution, prelicensure experience, Smog Check training courses, and whether there was need for additional training modules to adjunct their training. The full text of the questions and a summary of the group data are presented in Appendix B.

Survey #3: Owner/Supervisors' Assessment of Smog Check Technician Knowledge. Eighteen hundred and seventeen technician-owners or supervisors of private fleets were notified by mail. Of the 1,817 individuals, 666 were technician-owners of test-only stations. The individuals were instructed to use a unique username and password printed on a cover letter to access the survey on Comira's online survey system.

In this survey, a sample of technician-owners or supervisors of private fleets were asked about their facility, technician-employees, and the strengths and weaknesses of technician knowledge. The full text of the questions and a summary of the group data are presented in Appendix C.

Survey #4: Smog Check Technician Training Needs Assessment questionnaire. Three hundred twenty-eight technicians were sent a questionnaire by mail. The technicians represented all levels of experience with emission-related repairs. The technicians were instructed to complete the survey and return it to Comira's Folsom office in a stamped, self-addressed envelope.

In this survey, technicians were asked about their training and their experience before and after completing BAR courses. They were also asked to rate 66 tasks (developed in Workshop #2) that were organized in terms of nine content areas, e.g., vehicle inspection, emission test procedures, visual inspection, functional tests. A rating of 1 or 2 indicated that competency in the task was acquired during industry experience or required coursework before licensure. A rating of 3 or 4 indicated that competency in the task was acquired during industry experience or training after licensure. The full text of the questions and a summary of the group data are presented in Appendix D.

STUDENT ENROLLMENT STATISTICS

Information regarding course enrollment and licensing trends in Smog Check courses (CY 2004 through 2007).was obtained from BAR's Standards and Training website.

CANDIDATE EXAMINATION DATA

Candidate test data was obtained from the Department of Consumer Affairs' test delivery vendor to obtain pass/fail data from students who completed coursework at community colleges, private training institutions, and Regional Opportunity Programs (ROP)/high school/adult education programs.

An item analysis report of candidate test data conducted by the Department of Consumer Affairs' Office of Examination Resources for the Advanced Emissions (EA) examination (June 1, 2007 to March 31, 2008) was also provided.

PROPOSALS FOR RESTRUCTURING PROGRAM

Two proposals were examined. The first proposal was submitted in February 2007 by BAR's Ad Hoc Educational Advisory Committee (AHEAC) to restructure BAR's existing training program within the framework of BAR's current A6, A8, L1, Basic Clean Air Car Course (BCACC) and Advanced Clean Air Car Course (ACACC).

The second proposal was submitted by BAR to the National Automotive Technicians Education Foundation (NATEF) to create a training course and certification categories for California to encompass existing BAR alternative courses for A6, A8 and L1.

TEXTBOOK APPROVAL PROCESS

BAR staff and certified instructors were consulted to obtain information about the textbook approval process. A document entitled "Vendor Specifications for Bureau Training Program" was reviewed to obtain information about the textbook approval process.

SECTION 3: PROFILE OF SURVEY RESPONDENTS

SURVEY RESPONSE RATES

One-hundred eighteen (118/298 or 39%) BAR certified instructors completed the instructor training survey. Of the 118 instructors, 30 instructors reported teaching 1 to 3 courses and 25 instructors reported that they had not taught in the past two years. The remaining instructors reported teaching four or more BAR certified courses. Only the data for 63 instructors who taught four or more courses are displayed in Appendix A.

Four hundred (400/1,646 or 24%) recently licensed Smog Check technicians completed the technician training survey. Fifty-eight (58) surveys were returned to BAR as undeliverable.

Four hundred forty-seven (447/1,796 or 24%) technician-owners/supervisors completed the assessment of technician knowledge survey. Twenty-one notifications were returned as undeliverable. There were 25 requests for a paper copy of the survey from owners/supervisors who had difficulty accessing the online survey or who did not use a computer at home. Of the 25 requests, 21 technician-owners/supervisors returned the survey.

Eighty-five (85/323 or 26%) technicians completed the needs assessment questionnaire. Five were returned as undeliverable.

RESPONDENT DEMOGRAPHICS

Smog Check Program Training Survey (instructors)

Below are the demographics for instructor respondents:

- Approximately 40% had more than 10 years of experience
- Virtually all (62/63) had taught the BAR certified courses in the last four years, e.g., BAR update training course, Advanced and Basic Clean Air Car Courses, BAR Alternative courses for A6, A8, and L1, etc.
- Fifty-eight percent (58%) taught their courses at a community college
- Approximately 40% received 20 to 50 hours of supplemental training in engine, performance/emission diagnostics
- Fifty-seven percent (57%) reported engaging in hands-on training 21 to 30% of the time
- Forty-six percent (46%) of the instructors taught 8 to 12 classes in the past year.

Smog Check Program Training Survey (newly licensed technicians)

Below are the demographics for technician respondents:

- Over one-third (35%) were 35 to 50 years of age
- One hundred and ninety-two technicians received their BAR training at a private vocational school
- One hundred eighty-two technicians received their BAR training at a community college
- Fifty-four percent (54%) were currently employed at a test and repair station
- Forty-one percent (41%) had been licensed 1 to 2 years and 25% had been licensed 6 months to 1 year
- Thirty-eight percent (38%) had more than 5 years of automotive experience prior to starting their first BAR course
- Forty-three percent (43%) completed more than 5 automotive courses prior to starting their first BAR course,
- Seventy-five percent (75%) completed the BAR Alternative course in advanced engine performance
- Twenty-one percent (21%) reported that they had not taken any automotive training course prior to starting their first BAR course
- Nearly 25% of the technicians reported that they had less than one year of automotive trade experience prior to taking their first BAR course
- Seventy-six percent (76%) had not used the Internet for individual learning purposes in non-BAR training courses
- Sixty-seven percent (67%) had not used the Internet for distance learning for non-BAR training course

Owner/Supervisors' Assessment of Technician Knowledge

Below are the demographics for owner/supervisor respondents:

- Fifty-five percent (55%) worked at a test and repair facility
- Thirty percent (30%) had been performing Smog Check inspections 1 to 5 years, 17% had been performing Smog Check inspections for 6 to 9 years, and 32% had been performing Smog Check inspections for 10 to 20 years
- Half of the respondents were one-person shops while 40% employed 1 to 2 additional technicians
- Seventy-six percent (76%) had a computer that technicians actively used to access the Internet to obtain information from manufacturer websites or online resources

Of the stations that provided emission-related repairs, it should be noted that the number of Smog Check repairs performed monthly varied greatly.

Technician Training Needs Assessment

Below are the demographics for technician respondents:

- Fifty-four percent (54%) received their training at a private vocational school while 47% received training at a community college
- Nearly 90% reported obtaining the greatest amount of experience in emission-related inspections and/or repairs at a licensed test and repair facility
- Seventy-six percent (76%) had 11 or more years of training as a licensed Smog Check technician
- Almost all held ASE certifications for A6 (N=72), A8 (N=75), and L1 (N=67)
- Fifty-four percent (54%) had more than 5 years of automotive experience prior to starting their first BAR course
- Thirty-six percent (30%) had completed more than 5 automotive courses prior to starting their first BAR course
- Forty-six technicians completed the L1 alternative, 31 completed the A8 alternative, and 33 completed the A6 alternative

SECTION 4: PROPOSED INITIATIVES

CONTRACT OBJECTIVE "A"

> "*Evaluate BAR's current training strategy in light of proposed initiatives. Compare Ad Hoc Educational Advisory Committee (AHEAC) proposal, BAR's proposed NATEF training course alternatives, and other identified options for accomplishing basic automotive technology training for entry-level Smog Check technicians*."

KEY FINDINGS

CURRENT LICENSING STRATEGY

Appropriateness of current licensing strategy. BAR's current licensing strategy, which might best be described as "one size fits all," because it requires all technicians to complete emissions-related courses and pass a licensing examination that includes questions on vehicle inspection as well as diagnosis and repair. This strategy does not appear to be appropriate for the portion of the licensee population that only performs inspections. It is likely that upcoming program changes (e.g., diesel vehicle inspection) and some changes under consideration (e.g., OBD only testing), will further undermine the current licensing strategy if not changed.

On the other hand, because many, if not most, of California Smog Check technicians are employed in one-person shops, BAR training is under pressure to produce journey-level technicians skilled in diagnosis and repair, without the benefit of apprenticeship or mentorship programs. If more diagnostic and hands-on training for EA technicians were provided, repair effectiveness is likely to improve. However, cost considerations and pressures from those who perform inspections only prevent the expansion of training from beyond the current requirement of 168 hours.

Change in licensee demographics. Program dynamics and marketplace needs that impact BAR's training of Smog Check technician candidates are changing. At present there appears to be an oversupply of Smog Check technicians. According to statistics based on state licensing examinations and course enrollment gathered from 2004 to 2007, the number of technician candidates attending BAR core courses dropped significantly. For example, candidates enrollment in BAR A6 Alternative was 3,342 in 2004 but 2,253 in 2007. Similarly, enrollment in the Advanced Clean Air Car Course was 3,837 in 2004 but only 2,281 in 2007. During the same period, 4,385 out of 6,910 (63.5%) Smog Check technician candidates passed the state licensing examination.

Of this total, 97.56% (6,296) were licensed as EA technicians and only 2.44% (157) were licensed as Basic Area (EB) technicians. Considering the limited number of candidates seeking an EB license, and the difference between an EB and an EA technician is approximately 10 to 12 hours of additional course work (ASM inspections, NOx diagnostics), the EB license type should be phased out.

Two-tiered licensing system. The most direct support for a two-tiered licensing system comes from the evaluation of the 2006 occupational (job) analysis of Smog Check Technician practice. The results from the 2006 occupational analysis identified the content domains for Smog Check Technicians working in test-only stations.

The results from the 2006 occupational analysis indicated that inspection only technicians did not perform tasks related to "Diagnosis" and "Performing and Verifying Repairs." It is problematic to require technicians to be examined on tasks that are not part of their job. The defensible process is to design examination for particular jobs. The 2006 occupational analysis does not support examining inspection only technicians on "Diagnosis" and "Performing and Verifying Repairs."

It is noteworthy that during the process of revising the tasks from the 2006 occupational analysis for the needs assessment questionnaire (Survey #4), focus group participants concluded that there were significant gaps in content coverage of practice that were likely to affect the content assessed on the licensing examination. It is also noteworthy that the revised list of tasks was useful for establishing when (prior to or after licensure) technicians acquired competencies; however, the list of tasks did not adequately capture the skill level necessary to perform inspection only vs. diagnosis and repair.

AD HOC EDUCATIONAL ADVISORY COMMITTEE (AHEAC) PROPOSAL

The proposal submitted in February 2007 by AHEAC for revising and updating BAR's existing training program that culminates in licensure indicated that BAR and a committee of educators work within the existing framework to realign some topics, update subject content and revamp course hours.

Under the proposal, the combined course length for the A6, A8, and L1 courses (renamed Phase I, II, and III) would be increased to 108 hours (up from the 72 hours that are now minimally required). The combined course length for the Basic and Advanced Clean Air Car Courses would be reduced to 80 hours (down from the 96 hours that are now minimally required). Thus, the total hours of training for an EA technician would increase from 168 to 188.

The AHEAC proposal provides a clear list of subject areas and topics to be covered in each course, and includes a preset minimum number of hours for laboratory work and homework assignments. Overall, the restructuring attempts to address the need to increase hands-on experience. The proposal indicates that ASE certification would not be accepted in lieu of Phase III (L1) training for initial Smog Check Technician licensing, due to the increased emphasis in the Phase III course on hands-on assignments. The

AHEAC plan requires participants in the Phase III course to satisfactorily complete all laboratory assignments to be eligible for taking the course examination.

The AHEAC proposal contains many elements that merit consideration. However, it does not address a basic structural problem in the current program and that is the disparity between the knowledge and skills required for a technician who only conducts inspections and one that performs diagnosis and repairs.

BAR'S PROPOSAL TO NATEF

The proposal submitted by BAR to the National Automotive Technicians Education Foundation (NATEF) asks NATEF to create two new certification categories to cover driveability and emissions. If NATEF creates the new certification categories, BAR proposed requiring all applicants seeking initial Smog Check licensure to complete the NATEF new certifications that encompass the A6 (diagnosis and repair of emission-related electrical/electronic systems), A8 (diagnosis and repair of emission-related engine performance systems), and L1 (diagnosis and repair of emission-related advanced engine performance systems) certifications.

Existing licensees seeking renewal would still be able to use ASE certifications to renew their Smog Check license. BAR would accept NATEF certifications from the new certification categories from applicants attending any NATEF certified school. BAR would no longer design, develop, approve, and/or administer courses for California that specialize in intermediate electrical/electronic systems, intermediate engine performance systems, and advanced engine performance systems.

There are currently 44 BAR certified training institutions (36 community colleges and 8 private institutions) which are also certified by NATEF. BAR recognized that NATEF has rigorous standards for certifying schools including standards for program goals, program administration, learning resources, finances, student services, instruction, equipment, physical facilities, and instructional staff. NATEF also requires prospective institutions to provide documentation of certification standards and to undergo a two-day site visit, in addition to an initial "self evaluation" process and are subject to a one-day evaluation during the midpoint of the five-year certification period.

However, there are several concerns if initial applicants were required to complete the two NATEF courses. The major concern is that the number of class hours required to complete each NATEF course exceeds 200 hours, or roughly 10 times the length of BAR's Alternative courses for A6 and A8. Another concern is that NATEF certification is only offered twice a year. Finally, if schools were required to purchase additional tools and equipment to pass the NATEF evaluation, there is a concern that an unacceptable financial burden would be placed upon school resources.

RECOMMENDATIONS

RECOMMENDATION A1. Re-engineer BAR's Training Program to better accommodate inexperienced technicians by establishing a sequentially progressive training track.

Identify experienced/highly-trained technicians by developing a process for assessing knowledge, skills and abilities prior to training and only mandate training necessary relative to the candidate's knowledge, skills and abilities. BAR should accept existing nationally recognized automotive training, certification and degree standards such as National Institute for Automotive Service Excellence (ASE) certifications, National Automotive Technician Education Foundation (NATEF) accredited training programs, and recognized degree programs.

RECOMMENDATION A2. Conduct an occupational (job) analysis to identify the tasks performed and the knowledge base for technicians who perform inspections. The premise for an examination should be based on the results of an occupational analysis to identify the tasks performed and the knowledge skills, and abilities necessary to perform effectively.

The results of the occupational analysis will serve as the foundation for an examination that measures competencies required to conduct inspections but not perform emissions-related repairs.

RECOMMENDATION A3. Create a two-tiered system for applicants seeking initial licensure. This would involve creating a new licensure program for persons who performed inspections only. *(May need regulatory change)*

Two license types would be created: a license for conducting Smog Check inspections, and a license for performing diagnosis and repairs. The Emissions Inspection Technician license would require minimal training in engine performance and would focus on the laws and requirements of the Smog Check Program as well as the skills required to perform Smog Check inspections. The Emissions Diagnostic and Repair Specialist license, which requires an Emissions Inspection Technician license as a prerequisite, would require training in electrical/electronics, and advanced engine performance and driveability, or their educational or certification equivalent.

RECOMMENDATION A4. Create a transition period of one or two years prior to biennial renewal, in which persons who do not possess the ASE driveability certification, for example, would be required to obtain certification if they seek to obtain an Emissions Diagnostic and Repair Specialist license.

RECOMMENDATION A5. Stop licensing new EB technicians after December 31, 2009 and require existing EB technicians to successfully complete additional coursework (ASM inspections, NOx diagnostics prior to accepting positions in Enhanced Areas, as appropriate. *(May need regulatory change)*

SECTION 5: TRAINING AND EXAMINATION

CONTRACT OBJECTIVE "B"

> *"Assess, validate and make recommendations on BAR's practices relative to Smog Check technician training and examination as a prerequisite to biennial licensure renewal."*

KEY FINDINGS

Adequacy of training for performing emission-related repairs. Of the 400 Smog Check technicians (Survey #4), 82% "agreed" or "strongly agreed" with the statement that "Overall, the BAR Training that I received qualified me to perform emission-related repairs." It should be noted that many of the same technicians also stated that they would have benefited from additional hands-on training in emission-related diagnosis and repair. This data contrasts with 31% of the instructors (Survey #1) who indicated that BAR training adequately prepared students to diagnose vehicle emission failures or perform Smog Check inspections.

First-time and repeat test takers. An analysis of candidate data furnished by Consumer Affairs' test delivery vendor indicated that nearly 63.5% of all Smog Check candidates during the period 2001 to 2006 passed their initial examination for licensure. While a 63.5% pass rate is well within the range of acceptability for a professional licensing examination, BAR has reported a lower pass rate (51.7%) over the last four years for Smog Check candidates taking the state licensing examination. The lower pass rate is likely influenced by candidates who took the examination multiple times.

Job tasks. Technicians (Survey #4) identified 52 tasks that were likely acquired through industry experience or training prior to licensure (see Appendix F). Of these tasks, many tasks required low to moderate technical skills. Examples of these tasks include:

- Select vehicle gear as prompted by the analyzer during emissions testing.
- Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer.
- Determine if vehicle is required to be tested at a specific type of station (e.g., test-only, Gold Shield).
- Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number).

Technicians also identified 14 tasks that were likely acquired through industry experience or training following licensure. In particular, two tasks required higher level skills:

- Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced.

- Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed.

Not all 14 tasks identified as likely acquired through industry experience of training following licensure (see Appendix G) required higher level skills. Rather, these tasks required low to moderate skills. There are several influences that may have impact on the results. First, there were respondents who had 11 or more years of experience (76%). Second, 23% of the respondents indicated that they had not taken automotive courses prior the first BAR course. Third, 36% of the respondents indicated that they had taken more than five courses prior the first BAR course.

Job knowledge. During the process of revising the knowledge base from the 2006 occupational analysis for the needs assessment survey (Survey #4), focus group participants concluded that there were significant gaps in content coverage of practice that were likely to affect the content assessed on the licensing examination. While the revised list of knowledge was useful for establishing the knowledge base required to perform tasks on the job, the list of knowledge did not adequately differentiate between the knowledge necessary to perform inspections vs. diagnosis and repair (see Appendix E).

Current curriculum requires overhaul. Most instructors and some technicians commented that the current curriculum does not adequately prepare students to diagnose and repair vehicle emission failures. The data from 63 instructors (Survey #1) included in the analysis support this notion.

- Fifty-two percent (52%) indicated that both curriculum and course hours need to be overhauled.
- The five most important subject areas for which students need in-depth training include:

    - Theory and operations of Emissions Control Systems (N=34)
    - Basic electrical and electronic systems theory (N=33)
    - Advanced electrical/electronic system operations (N= 30)
    - Advanced engine performance (N=29)
    - Diagnosis and repair (N=28)

- Fifty-seven percent (57%) indicated that the time spent on emission-related diagnostic procedures should be significantly increased.

- Eighty-five percent (85%) indicated that an additional training module devoted to emission-related repairs should be added.
- Instructors indicated that curriculum and course materials should be updated and better integrated.

Need for additional training on specific topics. Many technicians (Survey #2) indicated that increased emphasis on specific topics would have benefited them in their job performance. Examples of topics include:

- Step-by-step diagnostic procedures to identify causes of emission failures (N=162)
- Theory and operation of CAN systems (N=137)
- Advanced scan tool usage (N=131)
- Application of Mode 6 (N=128)

Technicians also asked for more hands-on training to prepare them to work in an inspection environment as well as to perform diagnosis and repairs. They commented that hands-on exercises could include actual analysis of data and step-by-step diagnostic procedures.

Data from the instructors (Survey #1) further supported the implementation of additional training devoted to emission-related repairs. When asked "Do you believe an additional training module devoted to emission-related repairs should be added," instructors indicated that a module should be added to cover advanced topics related to emission-related diagnostic procedures and emission-related repairs.

Prerequisites. Instructors, in response to surveys and in workshops and interviews, proposed that BAR consider establishing some level of automotive training or ASE certification as a prerequisite to Clean Air Car Courses, and BAR update training courses. They also proposed that BAR consider requiring the Basic Clean Air Car Course as a prerequisite to the Advanced Clean Air Car Course.

Both instructors and technicians commented that BAR should develop and enforce a selection process to verify student experience. Such a process should include a means to verify a requisite amount of experience prior to admitting the students into BAR courses. If a prospective candidate has experience that cannot be readily documented, BAR should offer an option to challenge the prerequisites on a case-by-case basis. If the candidate's experience/training is extensive, the candidate should have a shorter path to licensure. If a student does not have automotive experience or training, there needs to be an avenue to enter the training program at a basic level.

System of accountability for schools/instructors. Comments from instructor and technicians indicated that BAR should create a system to make schools accountable. The system will require tools and processes to monitor school/instructor performance. The process could employ a variety of factors to rank schools according to student success on the licensing examination (pass rates), available resources (e.g., equipment, facilities), and end-of-course student surveys.

The results should be used as performance indicators to target institutions/instructors for audit. Standards should be developed and adopted for use in the audit process to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification.

BAR should also revise its standards for certifying instructors in a manner that establishes the appropriate level of technical expertise and subject area proficiency. New instructors should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies and skills to deliver training effectively. Evaluation could include direct observation by a qualified evaluator during classroom training in terms of standardized criteria for technical competence, instructional skills, and overall effectiveness in achieving the learning objectives.

A system of accountability can be accomplished now that BAR has the capability of accessing licensing examination data and school enrollment records by instructors to compare the pass rates on candidate data by school *and* instructor. Instructors with low pass rates, as measured by initial Smog Check license examination results, can be identified.

Initial pass rates. Analysis of examination results from technicians, school records, and BAR licensing data indicate there is a significant difference in the pass rate between candidates who trained at California Community Colleges (75%), versus those who trained at private training institutions (58%) or Regional Opportunity Programs/High Schools/Adult Education facilities (55%).

Based on the Smog Check Technician licensing examination results, initial pass rates vary widely between individual schools and instructors. An evaluation of BAR school enrollment and pass/fail data implies that some ineffective schools accept students into the program who should not be admitted (i.e., fail to meet minimum experience or education qualifications), and pass students who do not meet minimum requirements.

Smog Check licensing examination. The primary focus of the current Smog Check Technician Licensing examination is on low level skills. Because these functions represent the majority of tasks in the test specifications, the majority of the questions on the examination cover these topics. Therefore, a candidate could fail all diagnostic and repair-related questions and still pass the examination. BAR's current "one size fits all" licensing strategy may contribute to the possibility that some licensed technicians might not be able to effectively diagnose or repair a vehicle when it fails its Smog Check inspection.

At present, "end-of-course" examinations for BAR courses are administered by the schools and have been used for many years without safeguards for examination security (e.g., backup examinations, schedule for periodic replacement). BAR does not appear to have the resources to develop and maintain credible examinations for BAR

courses. As a result, some schools have 100% of their students pass the course, while the overwhelming majority of their students fail the BAR Smog Check licensing examination.

Internet and distance learning. Data from Survey #2 indicated that the majority of technicians[2] do not use the Internet for instructional purposes (76%) or for distance learning (68%).

- Only 24% of recently licensed technicians have participated in non-BAR training courses that used the Internet for teaching purposes.

- Only 20% claimed to have used the Internet for "distance learning" outside of the classroom setting.

It should be noted that the technicians in Survey #2 had little or no training beyond what BAR required. There is a general trend for vehicle manufacturers and government agencies to use the Internet as it is a cost effective means to disseminate information in a short amount of time.

Lack of automotive experience. There is a wide disparity in experience and skill level of candidates initially entering BAR training. Often, this disparity negatively affected the class learning experience and licensing examination results. It is reasonable to assume that lack of experience for some contributes to improper inspections and ineffective diagnosis and repair.

Twenty-one percent (21%) of the newly licensed technicians in Survey #2 reported that they had not taken any automotive courses prior to their first BAR course. It should be noted BAR has historically attempted to enforce a requirement that as a prerequisite to enrollment in the Clean Air Car Courses the student must have one year of automotive experience or equivalent automotive training courses in the engine performance area, but was unable to do so.

Technicians commented that students who lacked basic automotive training or experience negatively affected class discourse and often wasted time with trivial questions.

OTHER KEY FINDINGS

- The biggest obstacles that instructors (Survey #1) cited when teaching BAR certified training courses were:

  - Beginning students have less automotive experience and knowledge (N=40)
  - Curriculum and course content need to be updated and improved (N=38)
  - Students for whom English is a second language (N=25)

[2] Some technicians did not respond to this item.

- Thirty-eight percent (38%) of newly licensed technicians (Survey #2) reported having more than five years of automotive trade experience and 43% reported having taken more than five automotive courses prior to starting their first BAR course.

- Many technicians commented that there should be a minimum number of hands-on Smog Check inspections on actual vehicles that should be completed prior to completing the training program.

- When asked about the importance of multi-media, e.g., computer-based training, videos, and/or Internet learning materials, instructors were split. Thirty percent (30%) of the instructors indicated that providing multimedia learning materials was least important, while 29% indicated multimedia learning materials was very important.

RECOMMENDATIONS

RECOMMENDATION B1. Restructure content of courses into modules to allow flexibility in content and course offerings. BAR, working with others, should create a modular format so that older technologies and newer technologies can be presented in perspective, and older technologies or less important topics can be removed and replaced, as appropriate. The modular format should be designed to provide flexibility for schools in processing curriculum changes and adding new program requirements.

RECOMMENDATION B2. Courses should include more exercises involving diagnostic situations that utilize scan tool data and wiring schematics. The diagnostic situations should be designed to teach students to analyze vehicle systems using commonly encountered data.

RECOMMENDATION B3. Incorporate more hands-on exercises in the diagnosis and repair course that involve commonly encountered inspection and diagnostic situations. The exercises should emphasize development of diagnostic skills, use of data and scan tools, and following manufacturer's or other industry-accepted procedures in the process.

RECOMMENDATION B4. Refine standards and procedures for certifying instructors. Technical qualifications should be based on pre-established standards that describe the appropriate level of technical expertise and subject area proficiency.

Prospective instructors, who seek BAR certification, should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies to deliver training effectively.

Prospective instructors would be required to fulfill technical qualifications to ensure that their experience includes theoretical as well as in-depth practical knowledge of the material (e.g., provide documentation supporting prior education and experience, student evaluations of instructor effectiveness, student evaluations of course content, samples of course examinations, and proof of teaching ability prior to becoming certified by BAR). *(May need regulatory change)*

RECOMMENDATION B5. Develop new procedures to certify and/or audit training institutions and instructors. The procedures should include standardized measures to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification. *(May need regulatory change)*

RECOMMENDATION B6. Develop criteria for identifying underachieving instructors. Each training institution would be responsible for annual or biennial evaluations of certified instructors such that underachieving instructors would be required to take remedial coursework and document improvements that will be implemented in course instruction.

Underachieving instructors would be subject to disciplinary measures, e.g., remedial coursework, documentation of instructor competence, revocation of certification. Initial examinees should be surveyed regarding the quality of instruction obtained from both schools and instructors for all

BAR training courses prior to licensure. Renewal licensees should be surveyed during the application process. Surveys to be conducted electronically through BAR's examination contractor and/or online using BAR's website. *(May need regulatory change)*

RECOMMENDATION B7. Develop a "pass-fail" hands-on ("end-of-course") examination to be administered as part of the final examination at the school. The examination should assess the candidate's competencies to perform emissions-related inspections, diagnosis, and repairs. Develop procedures for administering and scoring the hands-on examination and keeping the examination current and secure.

RECOMMENDATION B8. Develop selection procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

RECOMMENDATION B9. Additional modules devoted to emission related repairs should be added to the training curriculum to better prepare technicians to perform emission-related repairs. The training modules would facilitate different inspection types (OBD II only, diesel, BAR 2010/tailpipe) and the distinction between technicians who perform inspections and technicians who perform diagnosis and repairs. A hands-on examination of student skills should be given prior to completion of inspection technician and diagnosis and repair technician coursework.

SECTION 6: TEXTBOOKS AND TRAINING MATERIALS

CONTRACT OBJECTIVE "C"

> *"Identify and recommend sustainable and defensible processes and procedures for textbook selection, training material development, and replacement practices and procedures."*

KEY FINDINGS

Textbook approval process. The existing textbook approval process is untenable. Currently, BAR receives textbooks from industry educators and practitioners, who have varying degrees of knowledge, experience, and writing skills. The authors must submit the books and obtain approval from BAR prior to using them in BAR Alternative courses. The Alternative courses are designed to provide the same level of qualification as would be obtained by a technician who obtained ASE A6, A8, and L1 certifications.

Then, BAR staff reviews the textbooks and determines the suitability of the books for use in training programs. BAR staff has prepared a description of the content that should be included in the textbooks and uses the content outline as criteria when evaluating the books.

The content that should be contained in the textbooks for BAR ASE Alternative courses is described in BAR's document, "Vendor Specifications for Bureau Training Program." The content for the textbooks are specified as Required Reading Topics. Broad categories and specific topics for training courses which should be included in the textbooks are shown in Table 3.

Table 3 – Topics to be included in textbooks

Topic	Subtopics
Electrical/electronic systems	• Diagnosing electrical problems using wiring diagrams • Voltage drop • Diagnosing and repair of open circuits, shorted circuits, grounded circuits, intermittents
Engine performance diagnosis and repair	• Evaluate/analyze HC, CO, CO_2 and O_2 gas readings • Diagnose ignition-related problems using oscilloscope/engine analyzer • Analyze engine-related mechanical problems using vacuum gauge results, compression test results

Topic	Subtopics
Advanced engine/emission systems diagnosis and repair	• Development of a systematic approach to diagnosing driveability complaints and emissions related failures • Diagnose and repair driveability problems and emissions failures • Diagnose and repair of malfunctioning ignition system • Diagnose and repair problems due to a malfunctioning feedback carburetor system • Diagnose and repair problems due to a malfunctioning throttle body or port fuel injection system • Diagnose and repair the cause of an evaporative control system emissions failure • Diagnose HC, CO, NOx, CO_2, and O_2 gas readings during loaded-mode testing

The most serious problem with the current process is that it is not a simple "go/no-go" process to compare the technical content of the books to the criteria. For example, a book is reviewed for technical content and editorial integrity such that BAR staff are required to provide edits for errors in grammar, spelling and punctuation as well as assist the authors in identifying weaknesses and improving the quality and coverage of the book, e.g., relocating sentences, paragraphs, or sections within a document.

In the current process, BAR staff serves as the editor of submitted textbooks such that authors expect BAR to go beyond identification of content shortfalls. BAR staff are expected to improve the quality and content of the technical material. Thus, if there are any errors in the approved textbook, the writers may challenge BAR staff and they assume that an approved book must be acceptable.

The entire process is typically carried out without educator or industry assistance; thereby placing BAR at risk of appearing subjective and indefensible. BAR staff may not be actively working as automotive technicians or qualified as professional editors so it is not reasonable to expect them to be fully qualified to evaluate the technical content from a subject matter expert's and editor's points of view. Both of these skill sets are needed in order to perform an adequate review. It is one thing to be knowledgeable of automotive technology but quite another to be qualified to review the textbooks from the perspective of an authority.

Role of instructors and SMEs. Most of the instructors (Survey #1) responded that BAR should work with a committee of subject matter experts (SMEs) paid by the state or a committee of educators to make curriculum and course material decisions. In restructuring BAR's curriculum, identifying subject areas and content, and selecting textbooks and materials, instructors responded that BAR and a committee of educators should work together throughout the process.

- When asked the question, "Who should identify subject areas for BAR courses," most of the instructors responded that a committee of SMEs paid by the state (42.9%) or both BAR and a committee of educators (38.1%). Only 1.6% responded that the curriculum should be specified by BAR only.

- When asked the question, "Who should specify the course curriculum for BAR courses," most of the instructors responded that a committee of SMEs paid by the state (27%) or both BAR and a committee of educators (52.4%). Only 3.2% responded that the curriculum should be specified by BAR only.

- When asked the question, "Who should select and approve textbooks and other resource materials for BAR courses," most of the instructors responded that a committee of SMEs paid by the state (25.4%) or both BAR and a committee of educators (46%). Only 4.8% responded that only BAR should select and approve textbooks and other resource material.

- When asked the question, "Who should provide the instructor update every two years?" instructors indicated three alternatives: an automotive expert hired by the state (31.7%), a knowledgeable BAR instructor (34.9%) or a combination of BAR and an automotive expert (15.9%). Only 17.5% of the instructors indicated that BAR staff should provide the biennial instructor update courses.

OTHER KEY FINDINGS

- Some of the textbooks submitted for BAR approval have used copyrighted material without permission.

- Both technicians and instructors (Surveys #1 and #2) suggested that BAR implement a process to update the content of the textbooks and media more frequently and include topics related to emission-related diagnostics and procedures rather than focusing on automotive basics learned elsewhere.

- Diagnostic and repair procedures should be presented in a step-by-step manner for a variety of vehicles demonstrating different causes for emission-related failures, problems associated with various gas readings, and various visual failures to aid technician in acquiring skill in diagnosis related to emission-related problems.

- In contrast to other professions, the Smog Check technicians have not established a common base of knowledge with a unifying theme. BAR staff and Industry professionals acknowledged that there is wide variation in the textbooks and related materials. The authors of the textbooks often write on subject matter on which they are most knowledgeable, consequently, textbooks do not provide even content coverage. The authors also have varying opinions on the relative importance of the content that should be included in the books.

RECOMMENDATIONS

RECOMMENDATION C1. Under BAR's guidance and direction, contract with a single vendor to provide a course curriculum and materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.

The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firms such as ASPIRE (Automotive Support Programs for Inspection, Repair and Emissions).

RECOMMENDATION C2. Contract with an automotive expert and/or utilize knowledgeable BAR certified instructors to serve as the primary instructors of the biennial instructor update course.

SECTION 7: RULES AND/OR MODELS

CONTRACT OBJECTIVE "D"

> *Identify and recommend rules and/or models for BAR to adopt when using Subject Matter Experts (SMEs) and/or Advisory Committees to provide outside expertise. Recommend rules and/or models that include written procedures to ensure participants will not engage in activities that could result in conflicts of interest."*

KEY FINDINGS

Use of a knowledgeable vendor. When establishing course curriculum, developing curriculum standards, and making decisions about course materials, BAR should contract with a single vendor to guide committees of subject matter experts. The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor's technical editors would be charged with ensuring that textbooks meet publishing standards. The Contract should include fair pricing provisions to ensure that course materials are affordable.

BAR should work closely with a standing committee of subject matter experts and a vendor, experienced in developing performance examinations, to develop hands-on exercises and the procedures for administering and scoring the examination. In this relationship BAR could act in a decision-making capacity to approve or disapprove content and to approve or disapprove the process by which the exercises are implemented and the examinations are administered. Hands-on examinations could be conducted at modular stations so that several students could be tested at the same time.

RECOMMENDATIONS

RECOMMENDATION D1.	Require each subject matter expert or vendor to sign a nondisclosure and/or examination security agreement prior to participation in any BAR-sponsored program activity.
RECOMMENDATION D2.	Establish steps to be taken if subject matter experts or vendors violate the terms of the nondisclosure and/or examination security agreement.

RECOMMENDATION D3. Verify that subject matter experts possess valid licenses and have a signed nondisclosure and/or examination security agreement within the past two years prior to participation in BAR-sponsored activities.

RECOMMENDATION D4. Create a database to track subject matter experts, including the names, addresses, and telephone numbers of all experts who sign the nondisclosure and/or examination security agreement.

RECOMMENDATION D5. Contract with a single vendor to design a hands-on "end-of-course" examination that meets BAR's specifications. The vendor should have technical expertise in emissions-related inspections, diagnosis and repairs as they relate to California rules and regulations.

The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firm such as ASPIRE.

RECOMMENDATION D6. Under BAR's guidance and direction, contract with a single vendor to guide committees of content experts in developing curriculum, curriculum standards, selection procedures for instructors, and outcome measures for students and training institutions. The vendor should be required to have technical expertise in emissions testing and automotive repair.

SECTION 8: PROPOSED MODELS

PROPOSED CRITERIA FOR SELECTING SMES

SME Selection criteria. Relevant stakeholders (instructors, technicians, technician-owners) should be included in all aspects of the decision making process. There are several criteria that should be considered when selecting subject matter experts for focus groups and advisory committees:

- Formal education in BAR training courses, particularly in emission-related courses
- Years of verified experience as a practicing Smog Check technician who routinely performs diagnosis and repair
- Geographic region, e.g., northern, central, southern California
- Type of practice setting, e.g., test and repair, Gold Shield
- Years of experience working with newly licensed Smog Check technicians

CURRENT MODEL FOR INITIAL LICENSURE

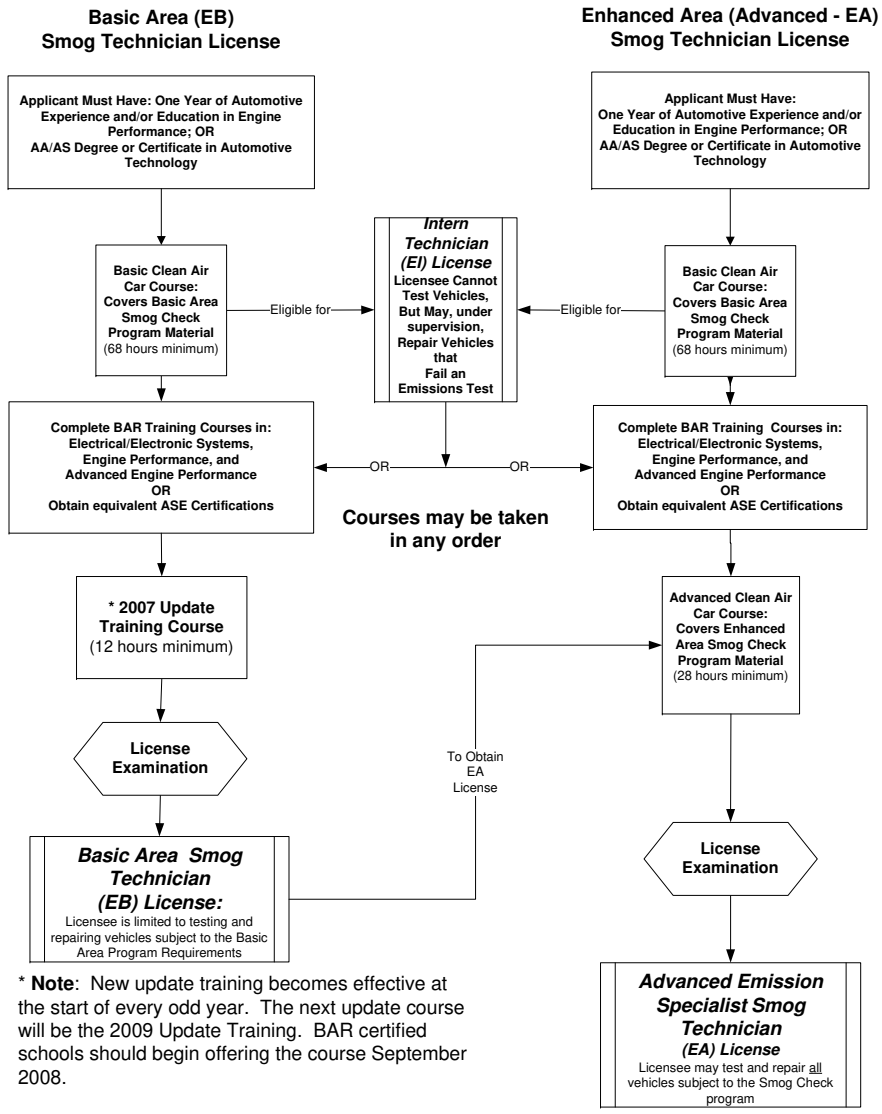
Figure 2 illustrates the current process for candidates who are seeking the Basic Area (EB) and the Enhanced Area (EA) licenses. What distinguishes the EA from the EB license is the requirement to take the Advanced Clean Air Car Course prior to taking the licensing examination.

The model proposes providing candidates in either track to have the option of obtaining an Intern Technician (EI) license, which allows them to repair vehicles that fail an emissions test while under supervision of a licensed Smog Check technician. Technicians may choose to stay in the EB track or take the Advanced Clean Air Car Course and obtain an EA license.

CURRENT MODEL FOR BIENNIAL RENEWAL

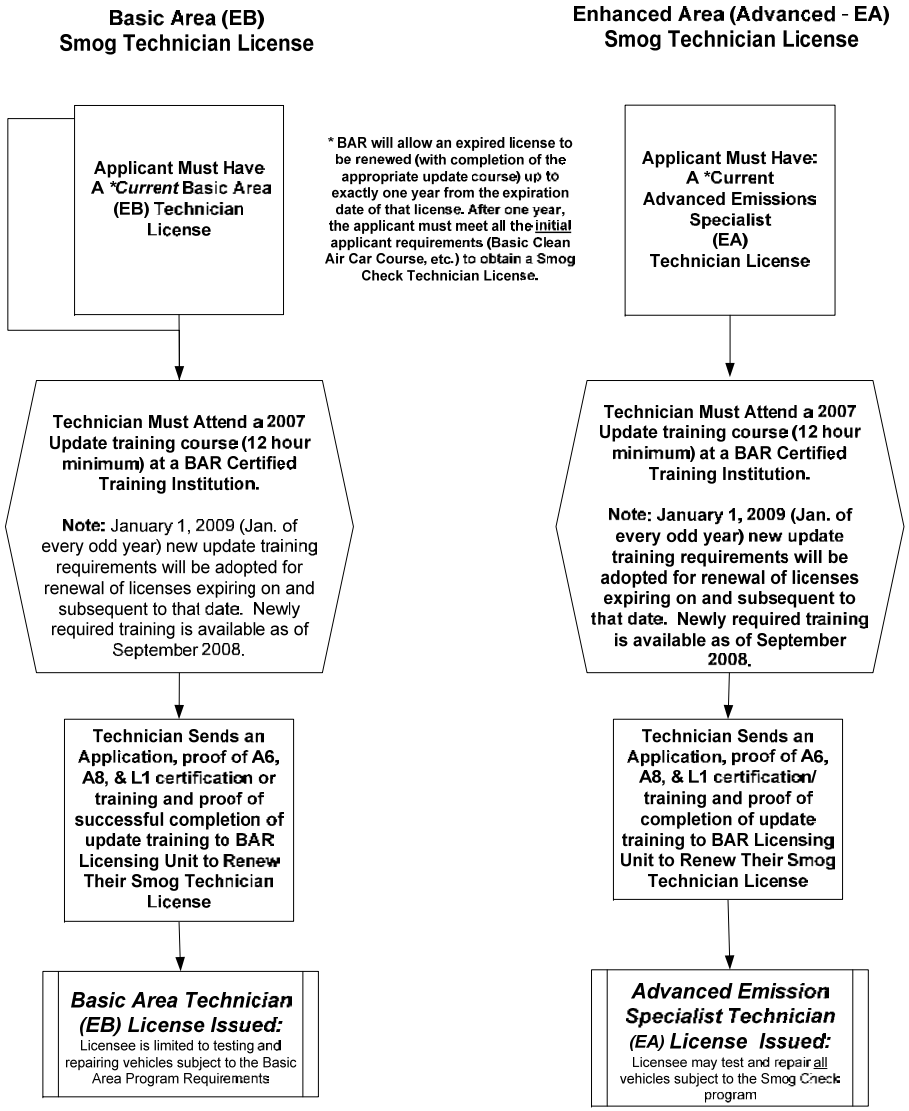
Figure 3 illustrates the current process for candidates who are seeking renewal of their EA or EB license. Both license types are required to hold a current license, take the update course, and provide proof of A6, A8, L1 certification and update training to biennial renewal.

Figure 2 – Current model for initial licensure


Basic Area (EB)
Smog Technician License
Enhanced Area (Advanced - EA)
Smog Technician License
Applicant Must Have: One Year of Automotive Experience and/or Education in Engine Performance; OR AA/AS Degree or Certificate in Automotive Technology
Applicant Must Have: One Year of Automotive Experience and/or Education in Engine Performance; OR AA/AS Degree or Certificate in Automotive Technology
Basic Clean Air Car Course: Covers Basic Area Smog Check Program Material (68 hours minimum)
Eligible for
Intern Technician (EI) License
Licensee Cannot Test Vehicles, But May, under supervision, Repair Vehicles that Fail an Emissions Test
Eligible for
Basic Clean Air Car Course: Covers Basic Area Smog Check Program Material (68 hours minimum)
Complete BAR Training Courses in: Electrical/Electronic Systems, Engine Performance, and Advanced Engine Performance OR Obtain equivalent ASE Certifications
OR
OR
Complete BAR Training Courses in: Electrical/Electronic Systems, Engine Performance, and Advanced Engine Performance OR Obtain equivalent ASE Certifications
Courses may be taken in any order
* 2007 Update Training Course (12 hours minimum)
Advanced Clean Air Car Course: Covers Enhanced Area Smog Check Program Material (28 hours minimum)
License Examination
To Obtain EA License
Basic Area Smog Technician (EB) License:
Licensee is limited to testing and repairing vehicles subject to the Basic Area Program Requirements
License Examination
Advanced Emission Specialist Smog Technician (EA) License
Licensee may test and repair all vehicles subject to the Smog Check program

* **Note**: New update training becomes effective at the start of every odd year. The next update course will be the 2009 Update Training. BAR certified schools should begin offering the course September 2008.

Figure 3 – Current model for biennial renewal

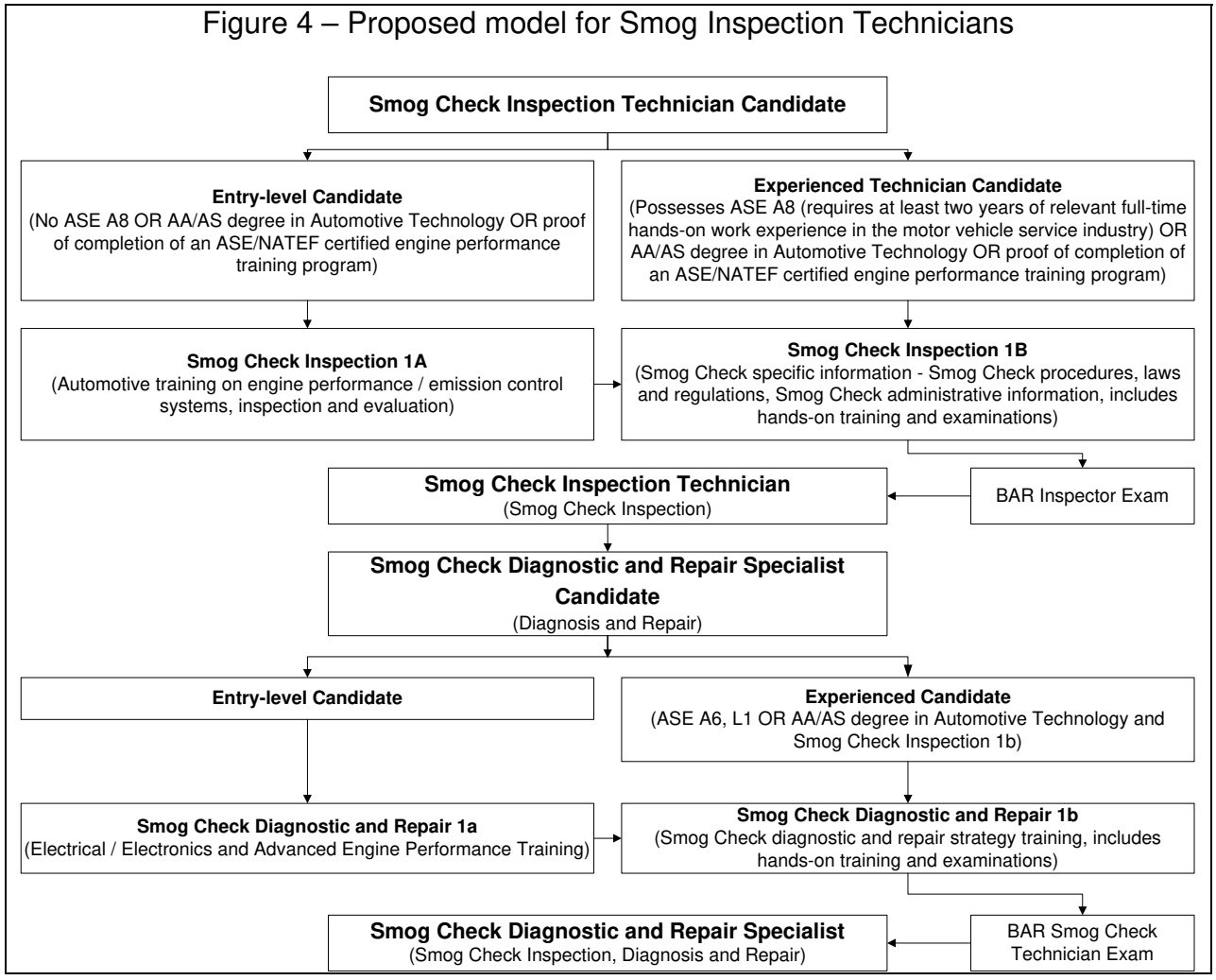

Basic Area (EB)
Smog Technician License
Enhanced Area (Advanced - EA)
Smog Technician License
Applicant Must Have A *Current Basic Area (EB) Technician License
* BAR will allow an expired license to be renewed (with completion of the appropriate update course) up to exactly one year from the expiration date of that license. After one year, the applicant must meet all the initial applicant requirements (Basic Clean Air Car Course, etc.) to obtain a Smog Check Technician License.
Applicant Must Have: A *Current Advanced Emissions Specialist (EA) Technician License
Technician Must Attend a 2007 Update training course (12 hour minimum) at a BAR Certified Training Institution.
Note: January 1, 2009 (Jan. of every odd year) new update training requirements will be adopted for renewal of licenses expiring on and subsequent to that date. Newly required training is available as of September 2008.
Technician Must Attend a 2007 Update training course (12 hour minimum) at a BAR Certified Training Institution.
Note: January 1, 2009 (Jan. of every odd year) new update training requirements will be adopted for renewal of licenses expiring on and subsequent to that date. Newly required training is available as of September 2008.
Technician Sends an Application, proof of A6, A8, & L1 certification or training and proof of successful completion of update training to BAR Licensing Unit to Renew Their Smog Technician License
Technician Sends an Application, proof of A6, A8, & L1 certification/ training and proof of completion of update training to BAR Licensing Unit to Renew Their Smog Technician License
Basic Area Technician (EB) License Issued:
Licensee is limited to testing and repairing vehicles subject to the Basic Area Program Requirements
Advanced Emission Specialist Technician (EA) License Issued:
Licensee may test and repair all vehicles subject to the Smog Check program

PROPOSED MODEL FOR SMOG INSPECTION TECHNICIANS

Figure 4 illustrates the proposed process for Smog Inspection Technician candidates. The process provides options for those candidates who have no experience and those who have ASE A8, an AA/AS degree, or proof of completion of an ASE/NATEF certified engine performance training program.

In this model, the candidate without experience must take automotive training on engine performance or emission control systems, inspection and evaluation before taking coursework on Smog Check specific information. By contrast, the candidate with experience does not have to repeat automotive training on engine performance or emission control systems, inspection and evaluation and can go directly into coursework with Smog Check specific information.

Figure 4 – Proposed model for Smog Inspection Technicians

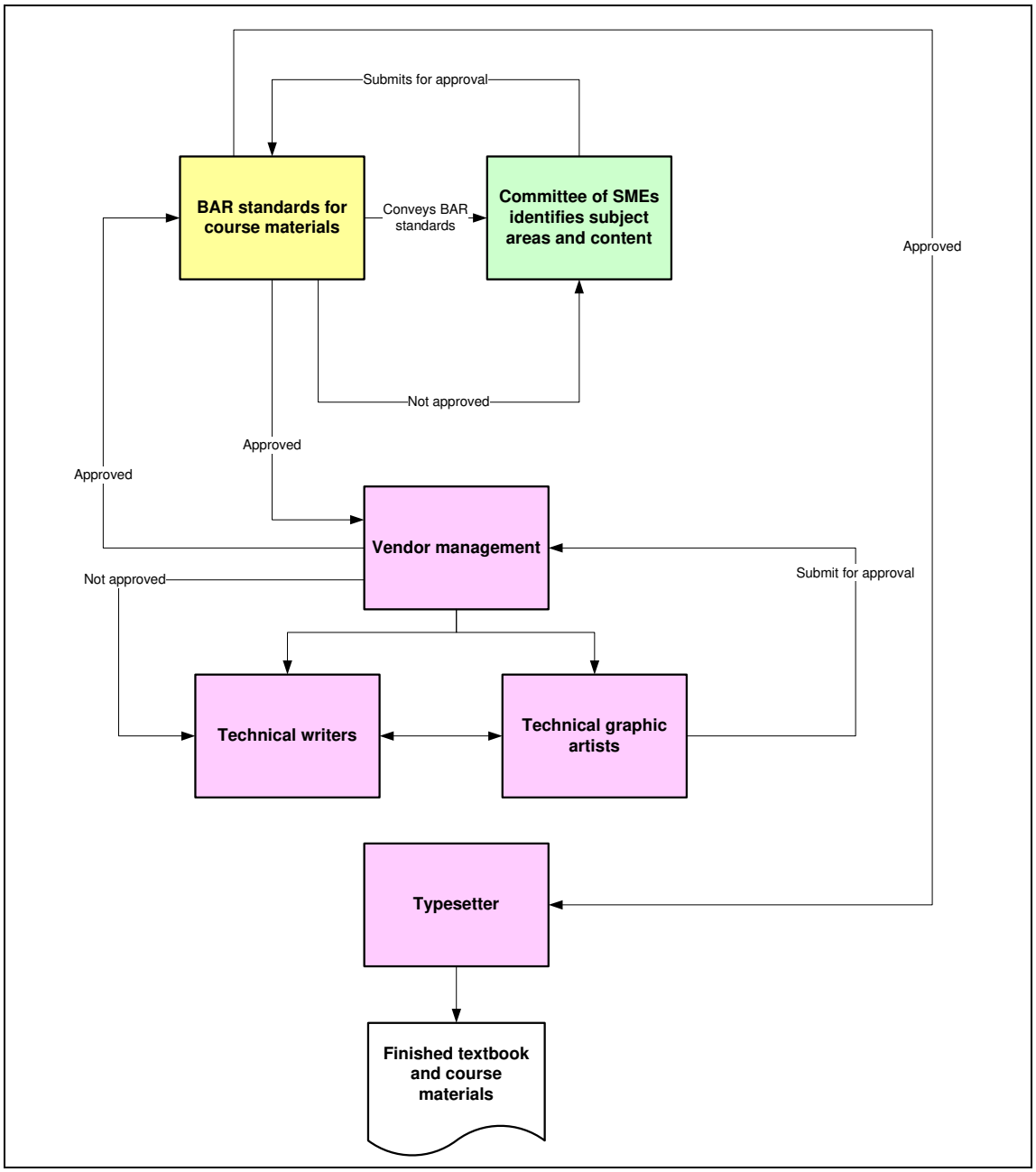

Smog Check Inspection Technician Candidate
Entry-level Candidate
(No ASE A8 OR AA/AS degree in Automotive Technology OR proof of completion of an ASE/NATEF certified engine performance training program)
Experienced Technician Candidate
(Possesses ASE A8 (requires at least two years of relevant full-time hands-on work experience in the motor vehicle service industry) OR AA/AS degree in Automotive Technology OR proof of completion of an ASE/NATEF certified engine performance training program)
Smog Check Inspection 1A
(Automotive training on engine performance / emission control systems, inspection and evaluation)
Smog Check Inspection 1B
(Smog Check specific information - Smog Check procedures, laws and regulations, Smog Check administrative information, includes hands-on training and examinations)
Smog Check Inspection Technician
(Smog Check Inspection)
BAR Inspector Exam
Smog Check Diagnostic and Repair Specialist Candidate
(Diagnosis and Repair)
Entry-level Candidate
Experienced Candidate
(ASE A6, L1 OR AA/AS degree in Automotive Technology and Smog Check Inspection 1b)
Smog Check Diagnostic and Repair 1a
(Electrical / Electronics and Advanced Engine Performance Training)
Smog Check Diagnostic and Repair 1b
(Smog Check diagnostic and repair strategy training, includes hands-on training and examinations)
Smog Check Diagnostic and Repair Specialist
(Smog Check Inspection, Diagnosis and Repair)
BAR Smog Check Technician Exam

PROPOSED MODEL FOR COURSE MATERIALS

Figure 5 illustrates the process by which textbook development and selection would proceed. Here, BAR sets the standards for all course materials. BAR works with a

committee of SMEs (paid by the state) to identify subject matter areas and content for the course materials. BAR selects a single vendor, knowledgeable of the field and of professional standards for publication, to develop textbooks and other course material. The vendor's management works closely with its technical writers and technical graphic artists to develop the content and graphics for the textbooks and other course material. The final draft of the material is submitted to BAR and subject matter experts, e.g., committee of instructors, for approval. Once the material is approved by BAR, the printer produces the final textbooks and other course material.

Figure 5 – Proposed model for selection of textbooks and course materials



SECTION 9: LIMITATIONS OF FINDINGS

Because Survey #1 included the majority of BAR certified instructors, there were no limitations on the results.

With respect to Surveys #2, #3 and #4, only licensed technicians completed the survey. The target samples did not include technicians who failed the Smog Check examination. Statistics indicate that nearly 37% of the candidates who take the examination fail on their first attempt. The fact that only licensed technicians participated in the surveys may account for the finding that technicians and technician-station owners reported that their knowledge of key subject matter areas was strong and they were satisfied with the training they received in the Smog Check training program. It is reasonable to assume that those who failed completed the training program with the intent of getting a license; however, the training program did not adequately prepare them for the Smog Check examination. Consequently, had the failing candidates been included in the survey, there may have been less satisfaction with the training program.

In Survey #3, approximately 9% of the technician-owners/supervisors employed three or more technicians. The remaining 50% were the sole technicians at the stations, and 40% employed an additional 1 to 2 technicians. As a result, the ratings may not be a true reflection of a supervisor assessing the strengths and weakness of other technicians. Rather, the ratings may be influenced by technicians in one-person shops were characterizing the strengths or weaknesses of their own competencies.

SECTION 10: SUMMARY AND CONCLUSIONS

RECOMMENDATIONS – REQUIRING LEGISLATIVE ACTION

The following recommendations will require changes in regulations:

RECOMMENDATION A3. Create a two-tiered system for applicants seeking initial licensure. This would involve creating a new licensure program for persons who performed inspections only.

Two license types would be created: a license for conducting Smog Check inspections, and a license for performing diagnosis and repairs. The Emissions Inspection Technician license would require minimal training in engine performance and would focus on the laws and requirements of the Smog Check Program as well as the skills required to perform Smog Check inspections. The Emissions Diagnostic and Repair Specialist license, which requires an Emissions Inspection Technician license as a prerequisite, would require training in electrical/electronics, and advanced engine performance and driveability, or their educational or certification equivalent.

RECOMMENDATION A5. Stop licensing new EB technicians after December 31, 2009 and require existing EB technicians to successfully complete additional coursework (ASM inspections, NOx diagnostics prior to accepting positions in Enhanced Areas, as appropriate.

RECOMMENDATION B4. Refine standards and procedures for certifying instructors. Technical qualifications should be based on pre-established standards that describe the appropriate level of technical expertise and subject area proficiency.

Prospective instructors, who seek BAR certification, should be required to complete an instructional basics training course and demonstrate that they possess the necessary competencies to deliver training effectively.

Prospective instructors would be required to fulfill technical qualifications to ensure that their experience

includes theoretical as well as in-depth practical knowledge of the material (e.g., provide documentation supporting prior education and experience, student evaluations of instructor effectiveness, student evaluations of course content, samples of course examinations, and proof of teaching ability prior to becoming certified by BAR).

RECOMMENDATION B5. Develop new procedures to certify and/or audit training institutions and instructors. The procedures should include standardized measures to assess quality of instruction and student outcomes. Underachieving institutions and/or instructors should be subject to remedial or disciplinary measures, including revocation of BAR certification.

RECOMMENDATION B6. Develop criteria for identifying underachieving instructors. Each training institution would be responsible for annual or biennial evaluations of certified instructors such that underachieving instructors would be required to take remedial coursework and document improvements that will be implemented in course instruction.

Underachieving instructors would be subject to disciplinary measures, e.g., remedial coursework, documentation of instructor competence, revocation of certification. Initial examinees should be surveyed regarding the quality of instruction obtained from both schools and instructors for all BAR training courses prior to licensure. Renewal licensees should be surveyed during the application process. Surveys to be conducted electronically through BAR's examination contractor and/or online using BAR's website.

RECOMMENDATIONS – REQUIRING PROGRAMMATIC CHANGES

The following regulations will require programmatic changes in the Smog Check training program:

RECOMMENDATION A1. Re-engineer BAR's Training Program to better accommodate inexperienced technicians by establishing a sequentially progressive training track.

Identify experienced/highly-trained technicians by developing a process for assessing knowledge, skills and abilities prior to training and only mandate training necessary relative to the candidate's knowledge, skills and abilities. BAR should

accept existing nationally recognized automotive training, certification and degree standards such as National Institute for Automotive Service Excellence (ASE) certifications, National Automotive Technician Education Foundation (NATEF) accredited training programs, and recognized degree programs.

RECOMMENDATION A2. Conduct an occupational (job) analysis to identify the tasks performed and the knowledge base for technicians who perform inspections. The premise for an examination should be based on the results of an occupational analysis to identify the tasks performed and the knowledge skills, and abilities necessary to perform effectively.

The results of the occupational analysis will serve as the foundation for an examination that measures competencies required to conduct inspections but not perform emissions-related repairs.

RECOMMENDATION A4. Create a transition period of one or two years prior to biennial renewal, in which persons who do not possess the ASE driveability certification, for example, would be required to obtain certification if they seek to obtain an Emissions Diagnostic and Repair Specialist license.

RECOMMENDATION B1. Restructure content of courses into modules to allow flexibility in content and course offerings. BAR, working with others, should create a modular format so that older technologies and newer technologies can be presented in perspective, and older technologies or less important topics can be removed and replaced, as appropriate. The modular format should be designed to provide flexibility for schools in processing curriculum changes and adding new program requirements.

RECOMMENDATION B2. Courses should include more exercises involving diagnostic situations that utilize scan tool data and wiring schematics. The diagnostic situations should be designed to teach students to analyze vehicle systems using commonly encountered data.

RECOMMENDATION B3. Incorporate more hands-on exercises in the diagnosis and repair course that involve commonly encountered inspection and diagnostic situations. The exercises should emphasize development of diagnostic skills, use of data and scan tools, and following manufacturer's or other industry-accepted procedures in the process.

RECOMMENDATION B7. Develop a "pass-fail" hands-on ("end-of-course") examination to be administered as part of the final examination at the school. The examination should assess the candidate's competencies to perform emissions-related inspections, diagnosis, and repairs. Develop procedures for administering and scoring the hands-on examination and keeping the examination current and secure.

RECOMMENDATION B8. Develop selection procedures to verify the required amount of experience prior to admitting the students into the Smog Check technician program.

RECOMMENDATION B9. Additional modules devoted to emission related repairs should be added to the training curriculum to better prepare technicians to perform emission-related repairs. The training modules would facilitate different inspection types (OBD II only, diesel, BAR 2010/tailpipe) and the distinction between technicians who perform inspections and technicians who perform diagnosis and repairs. A hands-on examination of student skills should be given prior to completion of inspection technician and diagnosis and repair technician coursework.

RECOMMENDATION C1. Under BAR's guidance and direction, contract with a single vendor to provide a course curriculum and materials for new vehicle technologies. The publisher should have technical expertise in emissions testing and automotive repair.

The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firms such as ASPIRE (Automotive Support Programs for Inspection, Repair and Emissions).

RECOMMENDATION C2. Contract with an automotive expert and/or utilize knowledgeable BAR instructors to serve as the primary instructors of the biennial instructor update course.

RECOMMENDATION D1. Require each subject matter expert or vendor to sign a nondisclosure and/or examination security agreement prior to participation in any BAR-sponsored program activity.

RECOMMENDATION D2. Establish steps to be taken if subject matter experts or vendors violate the terms of the nondisclosure and/or examination security agreement.

RECOMMENDATION D3. Verify that subject matter experts possess valid licenses and have a signed nondisclosure and/or examination security agreement within the past two years prior to participation in BAR-sponsored activities.

RECOMMENDATION D4. Create a database to track subject matter experts, including the names, addresses, and telephone numbers of all experts who sign the nondisclosure and/or examination security agreement.

RECOMMENDATION D5. Contract with a single vendor to design a hands-on "end-of-course" examination that meets BAR's specifications. The vendor should have technical expertise in emissions-related inspections, diagnosis and repairs as they relate to California rules and regulations.

The vendor should be required to have technical expertise in emissions testing and automotive repair. The vendor could be a community college automotive engineering department, the Foundation for California Community Colleges, or a private firm such as ASPIRE.

RECOMMENDATION D6. Under BAR's guidance and direction, contract with a single vendor to guide committees of content experts in developing curriculum, curriculum standards, selection procedures for instructors, and outcome measures for students and training institutions. The vendor should be required to have technical expertise in emissions testing and automotive repair.

CONCLUSIONS

A successful training program must focus on job-related activities if technicians are expected to competently perform emission-related inspections, diagnosis and repair. Therefore, inspection and diagnosis/repair technicians must learn theory as well as apply that theory to commonly encountered diagnostic situations that occur on the job.

To accomplish these ends, BAR should play a significant role in developing curriculum standards, instructor standards, student admission standards, instructor competency standards, and auditing quality of training institution facilities rather than developing and reviewing course materials.

BAR should contract with a vendor, knowledgeable in emissions-related inspection, diagnosis and repair, to design course materials and oversee curriculum standards. BAR should also utilize a vendor to facilitate committees of instructors and subject matter experts to select topics to be included in coursework and develop curriculum standards and course specifications.

BAR would continue to take the lead in designing testing procedures, certifying equipment and software, and updating Smog Check Program laws, regulations and requirements for licensed technicians.

Accountability for assessing instructor competency should be conducted periodically to ensure adherence to instructor competency standards developed by BAR. Selection criteria for admission into BAR Smog Check training programs should be developed by BAR and rigorously administered by the training institutions.

AREAS FOR ADDITIONAL STUDY

HANDS-ON EVALUATIONS

The content covered in hands-on training exercises and a hands-on "end-of-course" examination should take top priority for additional study. There are several important psychometric and practical issues that should be explored prior to developing defensible performance evaluations.

Structure and conceptual framework. Suitable content should be identified for the hands-on exercises. The best source of content comes from an occupational (job) analysis. The general rule of thumb is to identify content that requires candidates to apply knowledge and training within a systematic and time-limited framework. Content that can be assessed in other formats, such as multiple-choice examinations should be excluded. Once suitable content is identified, operational definitions of the constructs (concepts) to be assessed should be developed.

Standardized format. The tasks to be performed should be standardized and linked to the content identified in an occupational analysis.

Stimulus materials. The stimulus materials to be used should be the same for all candidates. By adopting a standardized approach, the only difference between the candidates is their application of their training and education. The stimulus materials should be equivalent for all candidates in terms of the types, amount of detail and complexity.

Scoring criteria and passing standards. Scoring criteria should be linked to the content identified in an occupational analysis so that examiners have an objective means to judge the quality of technician responses.

Scoring rubric. Scoring rubrics are crucial to the derivation of a fair and meaningful score for each candidate. The fairest approach is to sum the points from all subject matter areas in the hands-on evaluation.

Administrative protocols. Standardized administrative protocols for administering the examination should be developed to enhance reliability, reduce construct irrelevance, and ensure that every candidate has the same assessment experience.

Examiner training. Formal training and retraining of examiners is the most essential element of a performance examination. A sound training program is conducted well in advance of the performance examination and allows multiple opportunities for examiners to familiarize themselves with the scoring criteria and practical strategies for pacing the examination.

CORE COMPETENCIES OF TECHNICIANS UPON COMPLETION OF TRAINING

Survey #2 indicated that technicians want more specific diagnostic and repair information to help repair failing vehicles. BAR should consider providing real-time diagnosis and repair information to technicians to assist them in diagnosing the cause of vehicle failures in a cost-effective and efficient manner.

OBD II ONLY TESTING

The California Inspection and Maintenance Review Committee (IMRC), the U. S. Environmental Protection Agency (USEPA) and California Air Resources Board (ARB) are recommending inspection and maintenance (I/M) programs (including the California Smog Check Program) to consider the use of OBD II testing and the elimination of the tailpipe test for many or most 1996 and newer OBD II equipped vehicles. While OBD only may be less effective than an OBD plus tailpipe program, it is estimated that the simpler test would cost less than the current test. The equipment and technician skills required to perform an OBD only test are less than those to perform a tailpipe test. In the event that BAR adopts OBD only testing, such a change would raise new questions regarding the testing and training requirements for technicians.

NEW MANDATED REQUIREMENTS FOR VEHICLE INSPECTION

The Smog Check program is adding new mandated requirements to inspect diesel vehicles and anticipates the addition of other vehicles requiring inspection, e.g., motorcycles, hybrid vehicles, etc. BAR needs to be proactive in establishing processes and procedures to accommodate training for emissions-related inspection and repair of these vehicles.

SECTION 10: REFERENCES

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APPENDIX A: INSTRUCTOR RESPONSES

NOTE: Fifty-five of the 118 instructors were not included in the analysis because they taught only 1 to 3 courses or had not taught over the past two years. Therefore, only the results of 63 instructors are presented.

1. During 2007, approximately how many BAR certified courses have you taught?

For example, if you taught 1 ASE alternative course, 3 Basic Clean Air Car Courses, 4 BAR update training courses, and 1 Citation Level I course, you would check the box for "8 to 12 courses in total.

	Frequency	Percent
4 to 7 courses in total	14	22.2
8 to 12 courses in total	29	46.0
13 or more courses in total	20	31.7
Total	63	100.0

2. Approximately how many years have you been a BAR certified instructor?

	Frequency	Percent
2 years or fewer	4	6.3
3 to 5 years	15	23.8
6 to 10 years	18	28.6
More than 10 years	26	41.3
Total	63	100.0

3. Which of the following BAR certified courses have you taught within the last four (4) years? (Check all that apply)

BAR update training course (2007 and/or 2005)	61
Advanced Clean Air Car Course (ACACC)	53
Basic Clean Air Car Course (BCACC)	50
Automotive Electrical/Electronic systems (A6)	43
Automotive Advanced Engine Performance Specialist (L1)	42
Automotive Engine Performance (A8)	43
Citation Level I, and/or II	32
I have not taught BAR certified courses in the last four (4) years	1

4. **During 2007, in which of the following educational institutions have you taught BAR certified training courses?** (Check all that apply)

Community college	37
Private vocational school	25
Other	6
Occupational center	5
Regional Opportunity Program (ROP)	4

Other included: Fleet training, None, skill center

5. **How many hours of supplemental training have you received in the engine performance/emission diagnostic area in the past 2 years?**

   This does not include any training needed to maintain your Smog Check technician license or instructor certification)

	Frequency	Percent
0 to 5 hours	6	9.5
5 to 10 hours	4	6.3
10 to 20 hours	11	17.5
20 to 50 hours	27	42.9
More than 50 hours	15	23.8
Total	63	100.0

6. **Since 2004, BAR statistics reveal that more than 50% of all Smog Check candidates fail their state licensing exam.**

   Do you believe the current BAR certified course curriculum is adequate to prepare students to successfully pass the state exam and perform Smog Check inspections and emission-related repairs?

   Check the statement that best reflects your views.

	Frequency	Percent
Curriculum is adequate	2	3.2
Curriculum could be improved with a few minor adjustments	6	9.5
Curriculum is adequate, but needs to be updated	14	22.2
Curriculum is adequate but course hours need to be expanded	3	4.8
Both curriculum and course hours need to be overhauled	33	52.4
Other comments	5	7.9
Total	63	100.0

7. From your perspective, for students who are acquiring their Smog Check license what are the most important subject areas they need in-depth training on?

(Check a maximum of FIVE [5] top subject areas)

Theory and operations of Emission Control Systems (ECS)	34
Basic electrical (ignition) and electronic systems theory	33
Advanced electrical/electronic system operations	30
Advanced engine performance	29
Diagnosis and repair of emission-related electrical/electronic systems	28
Smog Check Program Rules and Regulations	26
Basic diagnostic processes and procedures	25
Diagnosis and repair of emission-related engine performance systems	25
Reading and interpreting system diagrams and schematics	22
Advanced fuel trim/delivery system diagnostics	21
Basic engine theory and testing procedures	20
General engine performance	19
On-Board Diagnostic (OBD) II fuel evaporative systems theory, operation and testing	18
Scan tool usage	18
Adaptive fuel trim strategies	15
Advanced diagnostic and repair procedures for CAN	15
Application of Mode 6 information for emission failure diagnostics	13
CAN operating systems	13
Proper use of diagnostic repair manuals	13
Electronic Throttle Control theory and operation	12
Emission control system (ECS) identification procedures	12
Theory and operations of fuel systems	11
Access procedures and use of Technical Service Bulletins	9
How to use the BAR-97 EIS and dynamometer	9
Using Lambda calculations to diagnose emission failures	8
Variable valve timing	8
Computer Re-flashing	7
Acceleration Simulation Mode (ASM) testing	6
Two-speed idle (TSI) testing	4

8. Check the top THREE (3) issues from those listed below that you believe pose the biggest obstacles to an instructor when teaching BAR certified training courses?

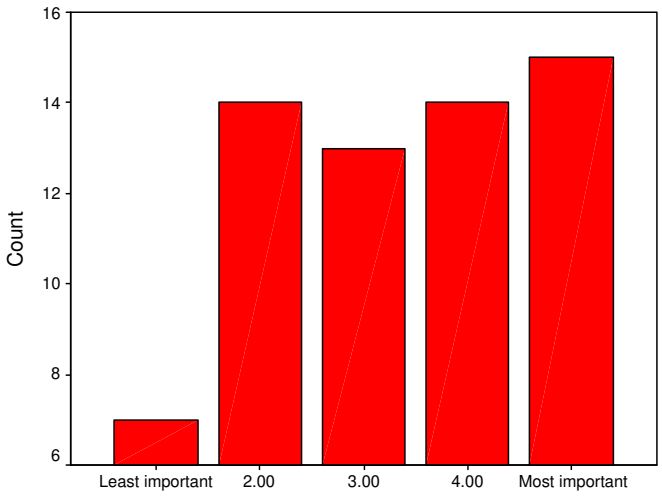
Beginning students today have less automotive experience and knowledge	40
Curriculum and course content need to be updated and improved	38
Students for whom English is a second language present increased challenges	25
Fewer students today are interested in a career as an automotive technician	17
Too much content for the number of course hours	15
Sufficient time is not available for adequate “hands-on” training	14
BAR provides inadequate support for developing and updating course materials	13
BAR commits inadequate resources to address the challenges instructors face in the classroom	13
The high cost related to purchasing and maintaining BAR-required equipment and tools	9
The school lacks sufficient resources to provide an adequate “hands-on” training experience	7

9. Rank, in order of importance, actions that BAR should take to improve the effectiveness of the Basic and Advanced

Check the boxes that correspond to your rankings for the following five actions. (1= least important, 5 = most important) Only one check should be placed in each column. There should be only one rank of 5, one rank of 4, one rank of 3, one rank of 2, and one rank of 1.

9(a) Update course text materials, handouts, and assignments

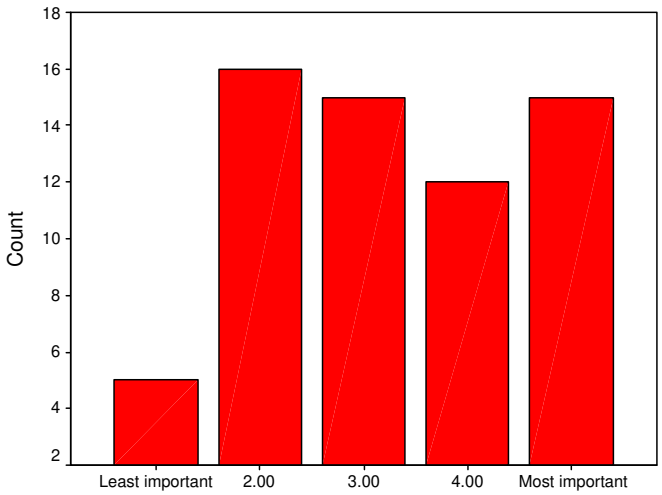
	Frequency	Percent
Least important	7	11.1
2.00	14	22.2
3.00	13	20.6
4.00	14	22.2
Most important	15	23.8
Total	63	100.0



Q9A Update course text materials handouts assignments

9(b) Revise the curriculum to better integrate new program requirements and key elements from prior update training courses

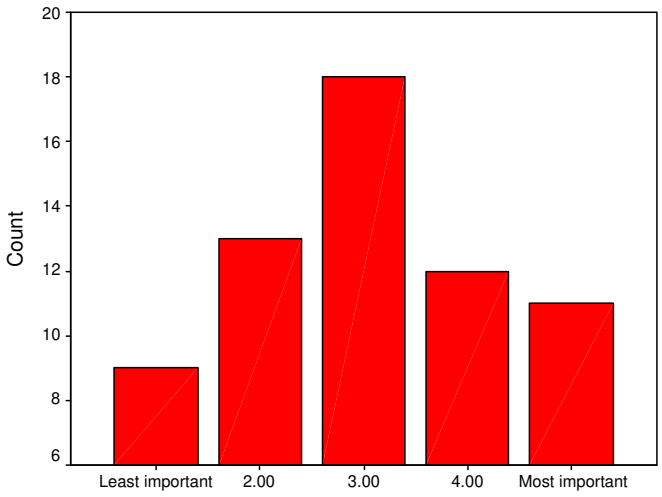
	Frequency	Percent
Least important	5	7.9
2.00	16	25.4
3.00	15	23.8
4.00	12	19.0
Most important	15	23.8
Total	63	100.0



Q9B Revise curr to better integrate new prg req/elements

9(c) Increase "hands-on" laboratory training

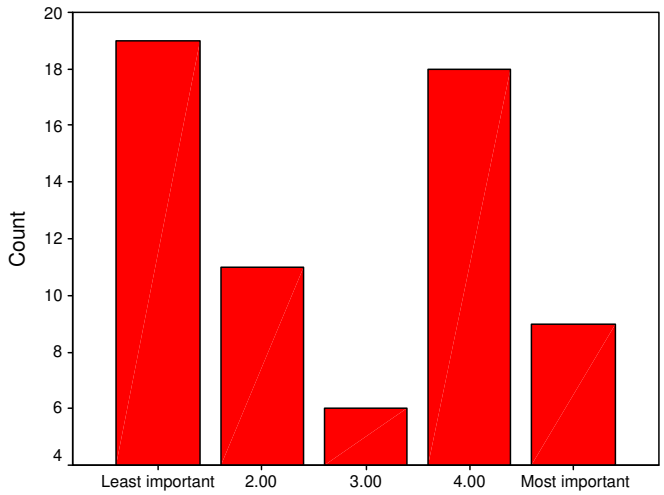
	Frequency	Percent
Least important	9	14.3
2.00	13	20.6
3.00	18	28.6
4.00	12	19.0
Most important	11	17.5
Total	63	100.0



Q9C Increase hands on lab training

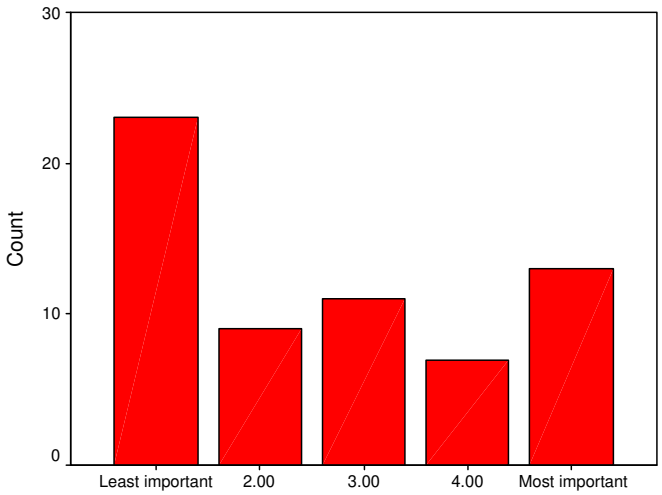
9(d) Provide multimedia (computer-based training, videos, and/or Internet) learning materials

	Frequency	Percent
Least important	19	30.2
2.00	11	17.5
3.00	6	9.5
4.00	18	28.6
Most important	9	14.3
Total	63	100.0



9(e) Expand the course hours to allow for adequate coverage of course content

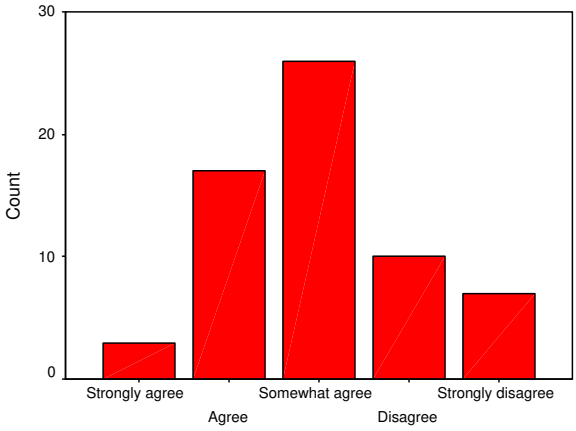
	Frequency	Percent
Least important	23	36.5
2.00	9	14.3
3.00	11	17.5
4.00	7	11.1
Most important	13	20.6
Total	63	100.0



Q9E Expand course hours to allow for adeq coverage

10. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and BAR update training courses adequately prepares students on the theory and operation of emission control systems?

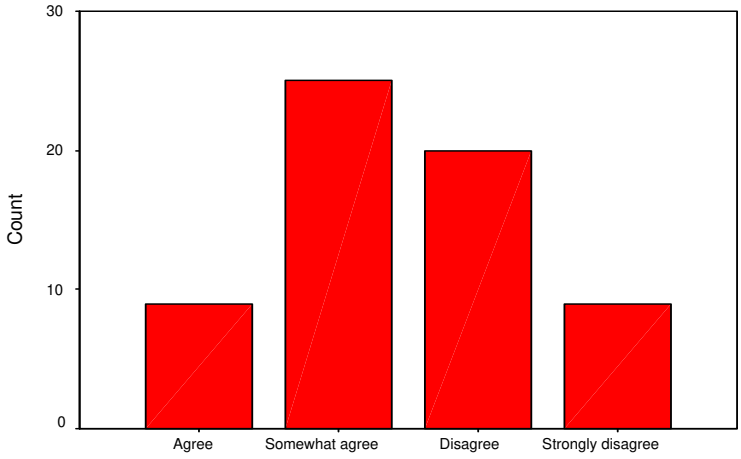
	Frequency	Percent
Strongly agree	3	4.8
Agree	17	27.0
Somewhat agree	26	41.3
Disagree	10	15.9
Strongly disagree	7	11.1
Total	63	100.0



Q10 Combined training prepares students on th/op of ECS

11. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and the BAR update training courses adequately prepares a student to diagnose and repair vehicle emission failures?

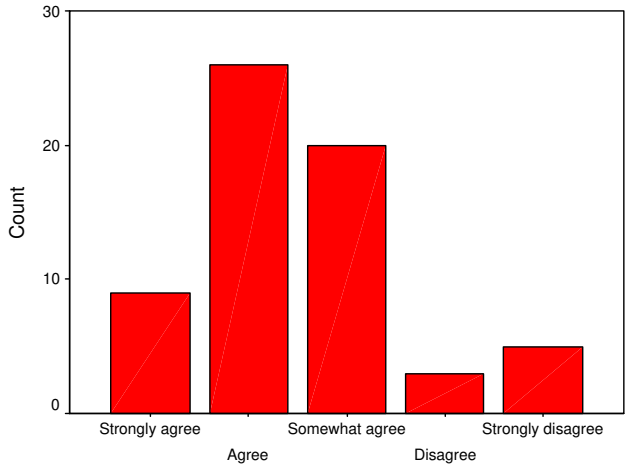
	Frequency	Percent
Agree	9	14.3
Somewhat agree	25	39.7
Disagree	20	31.7
Strongly disagree	9	14.3
Total	63	100.0



Q11 Combined training prepares students to diagnose and repair

12. From an instructor's perspective, do you agree that the combined training that includes the BAR ASE Alternative, Basic and Advanced Clean Air Car Course, and the BAR update training courses adequately prepares a student to properly perform a Smog Check inspection?

	Frequency	Percent
Strongly agree	9	14.3
Agree	26	41.3
Somewhat agree	20	31.7
Disagree	3	4.8
Strongly disagree	5	7.9
Total	63	100.0



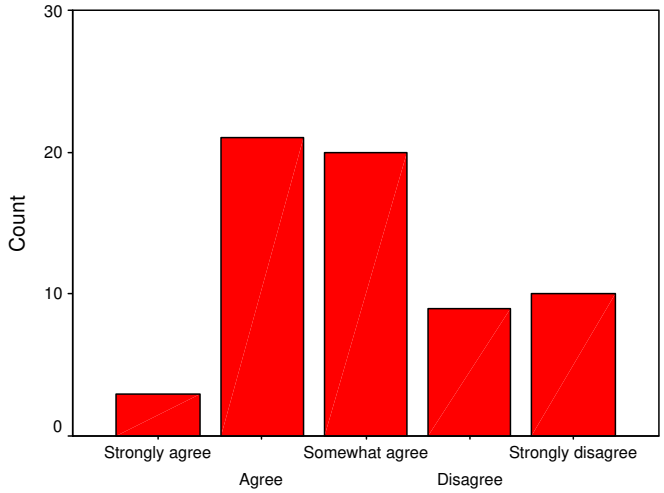
Q12 Combined trng prepares students to perform Smog Ck

13. For each BAR certified course listed below, select the level of agreement that most closely reflects your opinion about the following statement:

"The BAR-approved books and other printed material used for each course listed below are adequate for accomplishing the training objectives. Check the box that corresponds to your rating for each course."

13(a) Automotive Electrical/Electronic systems (A6)

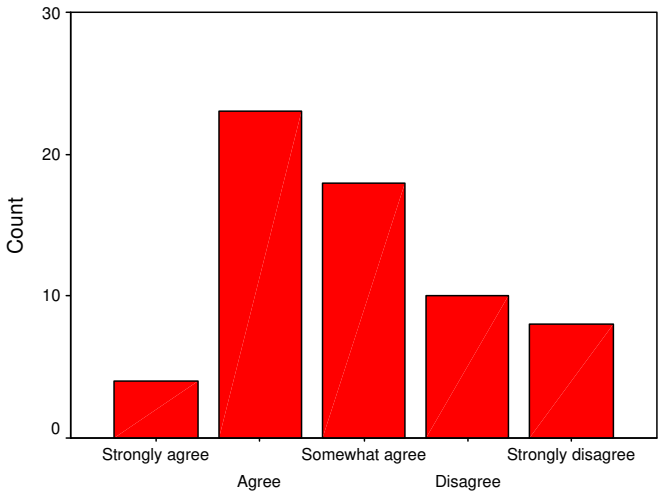
	Frequency	Percent
Strongly agree	3	4.8
Agree	21	33.3
Somewhat agree	20	31.7
Disagree	9	14.3
Strongly disagree	10	15.9
Total	63	100.0



Q13A A6 books and other material are adequate

13(b) Automotive Engine Performance (A8)

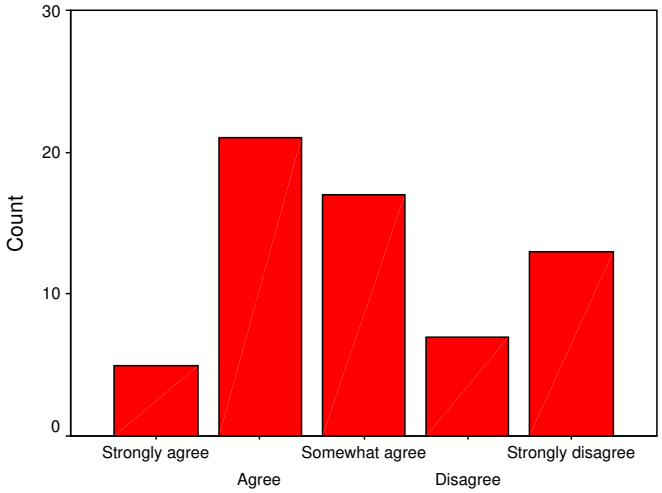
	Frequency	Percent
Strongly agree	4	6.3
Agree	23	36.5
Somewhat agree	18	28.6
Disagree	10	15.9
Strongly disagree	8	12.7
Total	63	100.0



Q13B A8 books and other material are adequate

13(c) Automotive Advanced Engine Performance Specialist (L1)

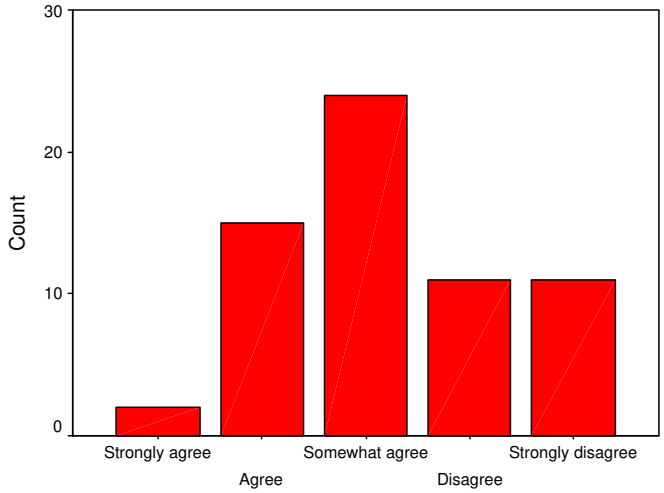
	Frequency	Percent
Strongly agree	5	7.9
Agree	21	33.3
Somewhat agree	17	27.0
Disagree	7	11.1
Strongly disagree	13	20.6
Total	63	100.0



Q13C L1 books and other material are adequate

13(d) Basic Clean Air Car Course (Basic CACC)

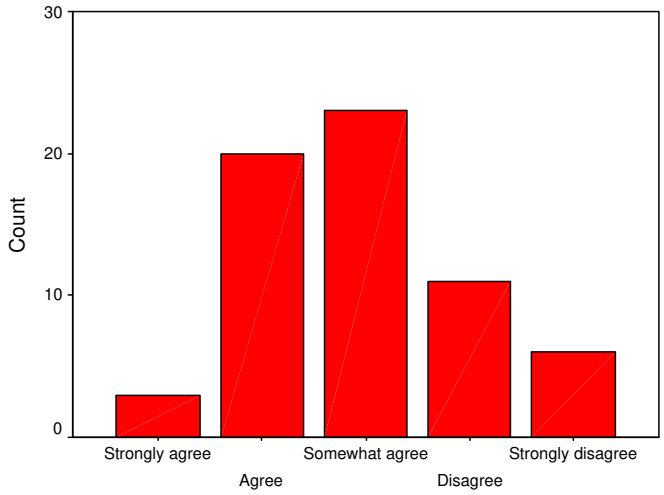
	Frequency	Percent
Strongly agree	2	3.2
Agree	15	23.8
Somewhat agree	24	38.1
Disagree	11	17.5
Strongly disagree	11	17.5
Total	63	100.0



Q13D Basic CACC Books and other material are adequate

13(e) Advanced Clean Air Car Course (Advanced CACC)

	Frequency	Percent
Strongly agree	3	4.8
Agree	20	31.7
Somewhat agree	23	36.5
Disagree	11	17.5
Strongly disagree	6	9.5
Total	63	100.0



Q13E Adv CACC books and other material are adequate

14. On average, when you instruct the BAR certified training courses, what percentage of time do you engaged in "hands-on" (laboratory) training?

	Frequency	Percent
0 to 10%	2	3.2
11 to 20%	15	23.8
21 to 30%	21	33.3
31 to 40%	10	15.9
41 to 50%	6	9.5
51 to 60%	7	11.1
61 to 70%	2	3.2
Total	63	100.0

15. From an instructor's perspective, based on the course content how many hours should the BAR have allocated for the BAR 2007 update training course?

	Frequency	Percent
12 hours	13	20.6
16 hours	26	41.3
20 hours	18	28.6
More than 20 hours	6	9.5
Total	63	100.0

16. Who should identify the course subject areas for the BAR courses?

	Frequency	Percent
BAR only	1	1.6
Instructors only	1	1.6
Both BAR and a committee of educators	24	38.1
Committee of SMEs paid by the state	27	42.9
Educational contractor hired by the state	1	1.6
Other	9	14.3
Total	63	100.0

17. Who should specify the course curriculum for the BAR courses?

	Frequency	Percent
BAR only	2	3.2
Instructors only	3	4.8
Both BAR and a committee of educators	33	52.4
Committee of SMEs paid by the state	17	27.0
Educational contractor hired by the state	1	1.6
Other	7	11.1
Total	63	100.0

18. Who should select and approve textbooks and other resource material for the BAR courses?

	Frequency	Percent
BAR only	3	4.8
Instructors only	5	7.9
Both BAR and a committee of educators	29	46.0
Committee of SMEs paid by the state	16	25.4
Educational contractor hired by the state	4	6.3
Other	6	9.5
Total	63	100.0

19. Would you support a "hands-on" examination (either computer generated or live exam) for students, upon completion of their required BAR courses? Assume that passage of the exam would allow the student to sit for the State Smog Check Technician examination.

	Frequency	Percent
Yes	48	76.2
No	15	23.8
Total	63	100.0

20. Do you believe an additional training module devoted to emission-related repairs should be added?

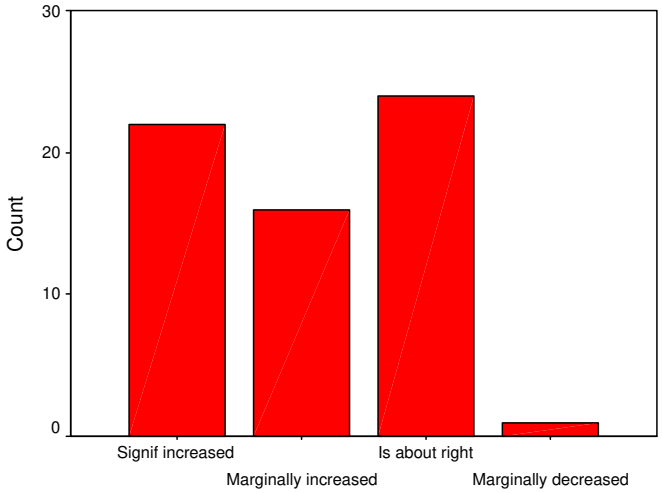
	Frequency	Percent
Yes	54	85.7
No	9	14.3
Total	63	100.0

21. For which of the following courses would you support a "challenge" examination (either computer generated or live "hands-on" exam) *in lieu* of the student taking a complete the BAR course?

	Frequency	Percent
I would not support a challenge examination	38	60.3
Basic CACC	4	6.3
Advanced CACC	1	1.6
A6 alternative	6	9.5
A8 alternative	3	4.8
L1 alternative	3	4.8
Update training	8	12.7
Total	63	100.0

22. The amount of time spent on course basic topics should be _____.

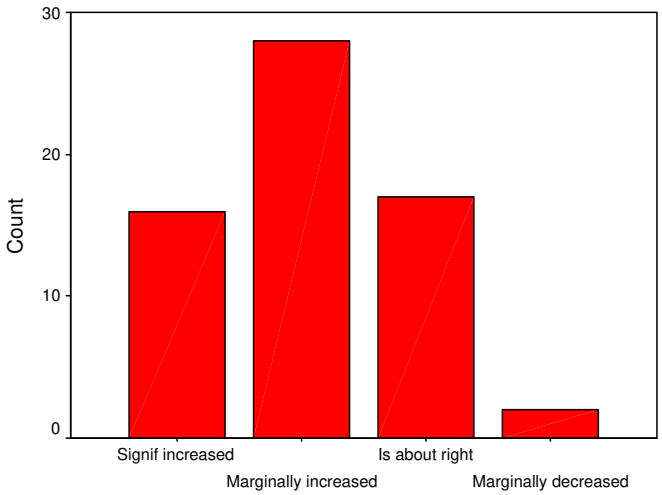
	Frequency	Percent
Significantly increased	22	34.9
Marginally increased	16	25.4
Is about right	24	38.1
Marginally decreased	1	1.6
Total	63	100.0



Q22 Time spent on basic topics should be _____

23. The amount of time spent on advanced course topics areas should be _____.

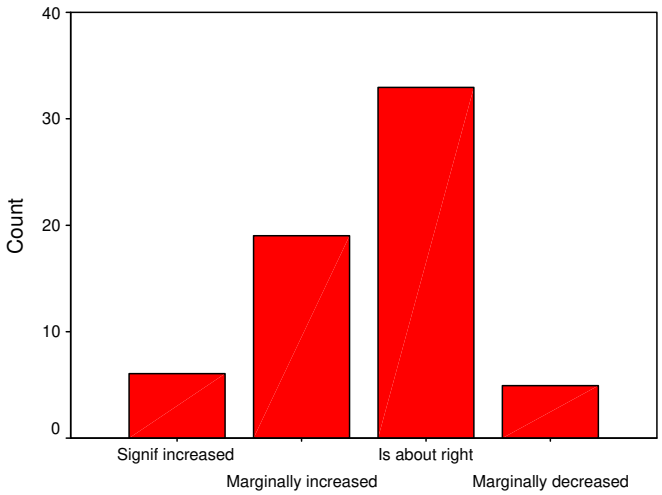
	Frequency	Percent
Significantly increased	16	25.4
Marginally increased	28	44.4
Is about right	17	27.0
Marginally decreased	2	3.2
Total	63	100.0



Q23 Time spent on adv topics should be _____

24. The amount of time spent on review of California rules and regulations (Smog Check Program) should be _____.

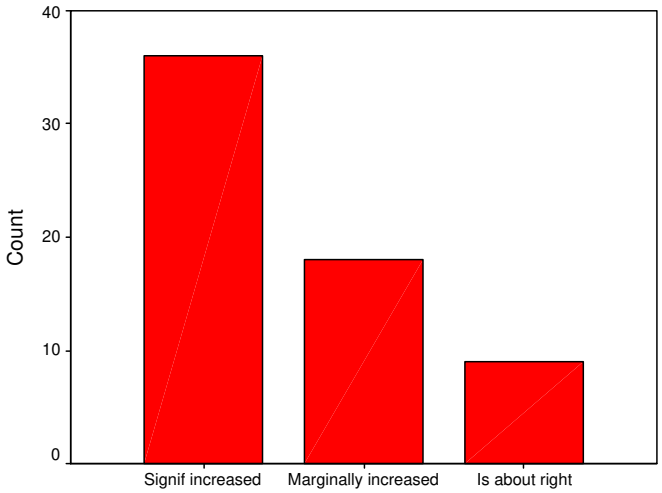
	Frequency	Percent
Significantly increased	6	9.5
Marginally increased	19	30.2
Is about right	33	52.4
Marginally decreased	5	7.9
Total	63	100.0



Q24 Time spent on Calif rules and regs should be _____

25. The amount of time spent on emission-related diagnostic procedures should be _____.

	Frequency	Percent
Significantly increased	36	57.1
Marginally increased	18	28.6
Is about right	9	14.3
Total	63	100.0



Q25 Time spent on emission related diag proc should be _____

26. The instructor update course (every two years) should be provided by:

	Frequency	Percent
BAR staff	11	17.5
An automotive expert hired by the state	20	31.7
A knowledgeable BAR instructor	22	34.9
Other	10	15.9
Total	63	100.0

APPENDIX B: TECHNICIAN RESPONSES

1. **Where did you obtain your BAR training? (Check all that apply)**

Private vocational school	192
Community college	182
Occupational center	33
Other	32
Regional Opportunity Program (ROP)	4

"Other" included: We Teach U, Medacon College, on the job, trade school

2. **Based on your answer to Question # 1, check the rating that corresponds to your overall rating of each school you attended for BAR training. Note that technicians could check all schools that applied to them.**

Poor	Fair	Average	Good	Excellent
7	9	41	165	248

3. **Where are you currently employed?**

	Frequency	Percent
Test-only station	74	18.5
Test and Repair incl Gold Shield	218	54.5
Fleet or referee facility	11	2.8
Emp but not at lic Smog Check	37	9.3
Not emp in auto repair	59	14.8
Total	399	99.8
Missing	1	.3
Total	400	100.0

4. **How many years have you been a licensed Smog Check Technician?**

	Frequency	Percent
1 to 6 months	91	22.8
6 months to 1 year	100	25.0
1 to 2 years	164	41.0
2 or more years	43	10.8
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0

5. **What National Institute of Automotive Service Excellence (ASE) certifications do you hold?**

Automotive Engine Performance (A8)	254
Automotive Electrical/Electronic systems (A6)	249
Automotive Advanced Engine Performance Specialist (L1)	197
Other	134

None	93

6. How much automotive trade experience did you have <u>prior</u> to starting your first BAR course?

	Frequency	Percent
No auto trade exp	46	11.5
1 to 6 mo	24	6.0
6 mo to 1 year	29	7.3
1 to 2 years	60	15.0
2 to 5 years	86	21.5
More than 5 years	154	38.5
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0

7. How many automotive training courses did you complete <u>prior</u> to starting your first BAR course?

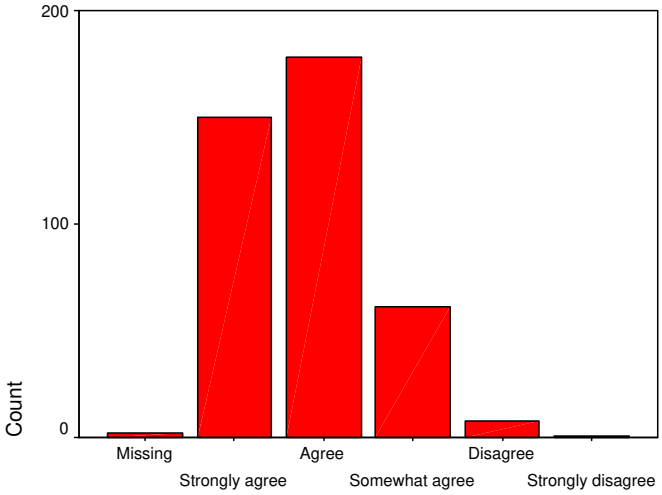
	Frequency	Percent
Have not taken any auto courses	84	21.0
1 to 2 courses	51	12.8
2 to 3 courses	37	9.3
3 to 4 courses	24	6.0
4 to 5 courses	28	7.0
More than 5 courses	173	43.3
Subtotal	397	99.3
Missing	3	.8
Total	400	100.0

8. Which of the following the BAR ASE Alternative courses have you completed? (Check all that apply)

Advanced Engine Performance	302
Electrical/Electronic systems	258
Automotive Engine Performance	254
None (did not complete any BAR ASE alternative)	92

9. Overall, the BAR training I received qualified me to perform emission-related repairs.

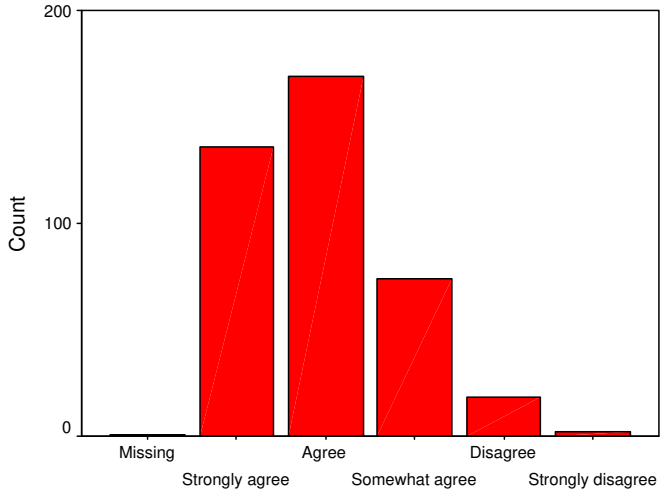
	Frequency	Percent
Strongly agree	150	37.5
Agree	178	44.5
Somewhat agree	61	15.3
Disagree	8	2.0
Strongly disagree	1	.3
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0



Q9_Overall BAR trng qualfied me to perf repairs

10. The BAR training I received provided me adequate training to diagnose vehicle emission failures.

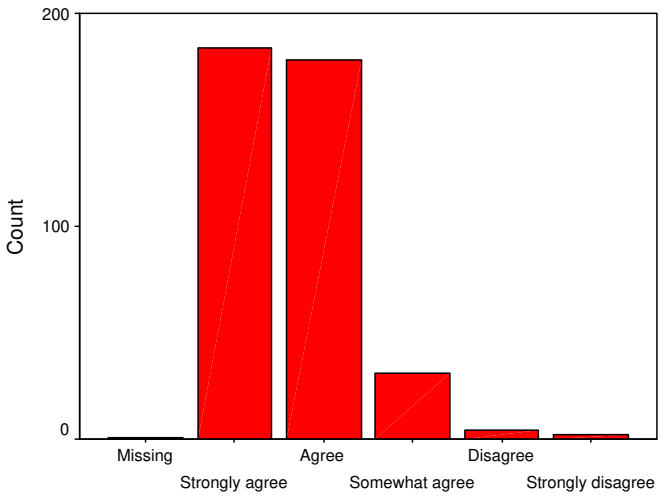
	Frequency	Percent
Strongly agree	136	34.0
Agree	169	42.3
Somewhat agree	74	18.5
Disagree	18	4.5
Strongly disagree	2	.5
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0



Q10_BAR trng provided adeq trng to diag emission failures

11. The BAR training I received provided me adequate training on the theory and operation of emission control systems.

	Frequency	Percent
Strongly agree	184	46.0
Agree	178	44.5
Somewhat agree	31	7.8
Disagree	4	1.0
Strongly disagree	2	.5
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0



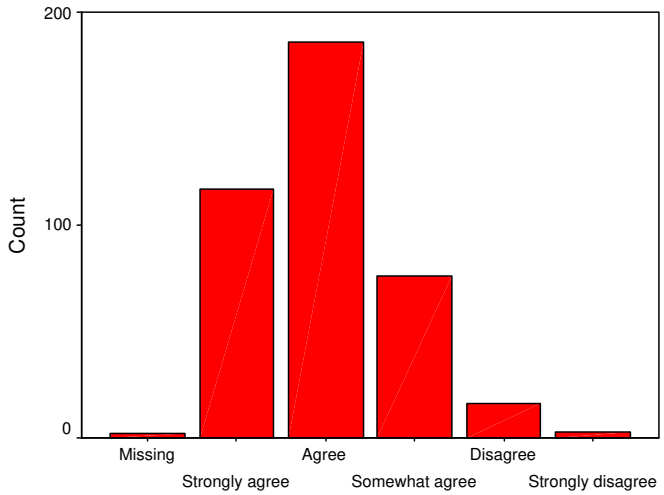
Q11_BAR trng provided adeq trng on th and op of ECS

12. During your BAR training courses, what percentage of time were you engaged in hands-on (laboratory) training?

	Frequency	Percent
No lab	1	.3
0 to 10 pct	25	6.3
11 to 20 pct	47	11.8
21 to 30 pct	50	12.5
31 to 40 pct	75	18.8
41 to 50 pct	70	17.5
51 to 60 pct	47	11.8
61 to 70 pct	25	6.3
71 to 80 pct	20	5.0
81 to 90 pct	21	5.3
91 to 100 pct	17	4.3
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0

13. The BAR classroom training that I received was sufficient to ensure adequate job performance.

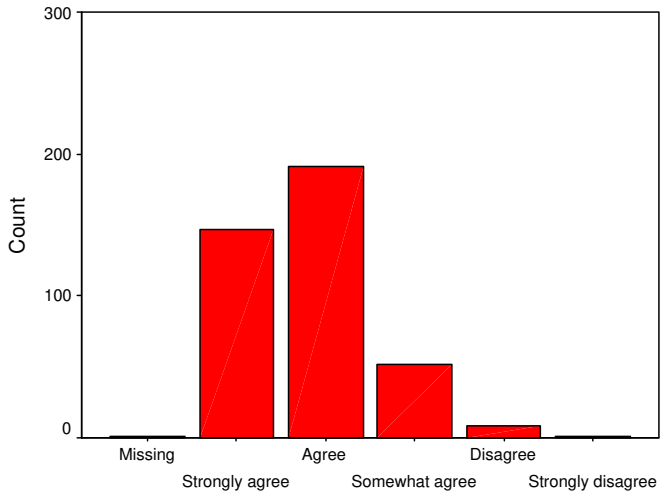
	Frequency	Percent
Strongly agree	117	29.3
Agree	186	46.5
Somewhat agree	76	19.0
Disagree	16	4.0
Strongly disagree	3	.8
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0



Q13 BAR classroom trng suff to ensure adeq job perf

14. The books and other printed material used during the BAR courses were adequate for the training provided to me.

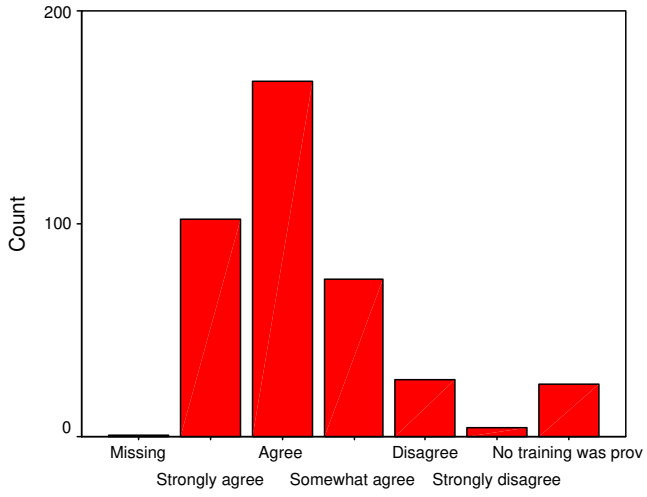
	Frequency	Percent
Strongly agree	147	36.8
Agree	191	47.8
Somewhat agree	52	13.0
Disagree	8	2.0
Strongly disagree	1	.3
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0



Q14 Bks and other print mat used in BAR courses adequate

15. During the BAR courses, the online resources (Manufacturer Internet websites, Mitchell-On-Demand, AllData, etc.) were explained to me in a manner that I can now apply this knowledge to emission failure repairs.

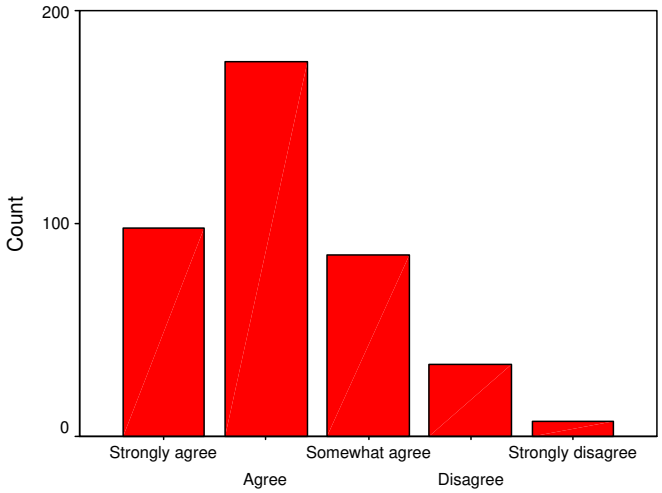
	Frequency	Percent
Strongly agree	102	25.5
Agree	167	41.8
Somewhat agree	74	18.5
Disagree	27	6.8
Strongly disagree	4	1.0
No training was provided	25	6.3
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0



Q15 Online resources explained to me apply to repairs

16. The amount of hands-on training that I received during the BAR courses was adequate to prepare me for the job.

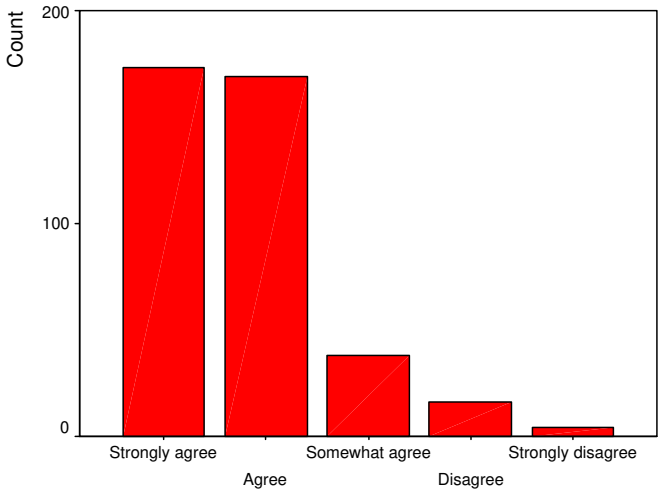
	Frequency	Percent
Strongly agree	98	24.5
Agree	176	44.0
Somewhat agree	85	21.3
Disagree	34	8.5
Strongly disagree	7	1.8
Total	400	100.0



Q16 Amt of hands on trng recd adeq to prep me for the job

17. During my BAR training courses, there was sufficient equipment (DSOs, DVOMs, etc.) to conduct the hands-on (laboratory) exercises.

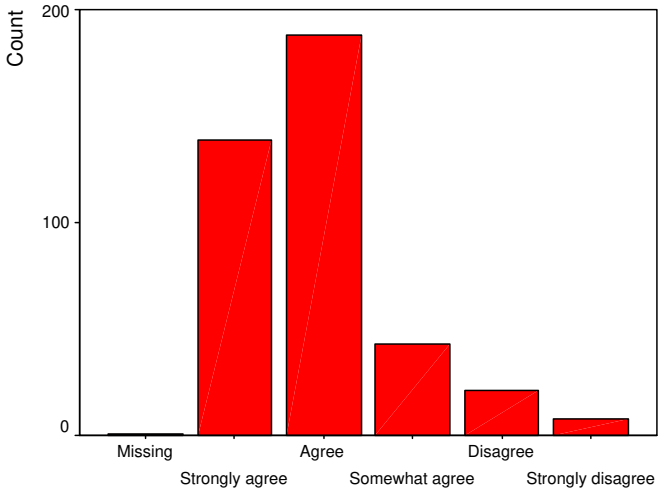
	Frequency	Percent
Strongly agree	173	43.3
Agree	169	42.3
Somewhat agree	38	9.5
Disagree	16	4.0
Strongly disagree	4	1.0
Total	400	100.0



Q17 Sufficient equipment to conduct hands on exercises

18. During my BAR training courses, there were sufficient demonstration vehicles to conduct the hands-on laboratory exercises.

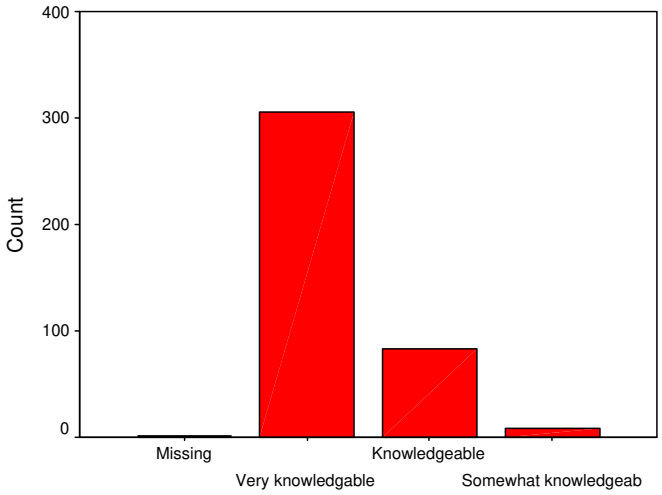
	Frequency	Percent
Strongly agree	139	34.8
Agree	188	47.0
Somewhat agree	43	10.8
Disagree	21	5.3
Strongly disagree	8	2.0
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0



Q18 Sufficient demo vehicles to conduct hands on exercises

19. On average, how knowledgeable was your BAR instructor?

	Frequency	Percent
Very knowledgable	306	76.5
Knowledgeable	83	20.8
Somewhat knowledgeable	9	2.3
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0



Q19 How knowledgable was your BAR instructor

20. On average, did your instructor ask for feedback from the students during the course(s) you attended?

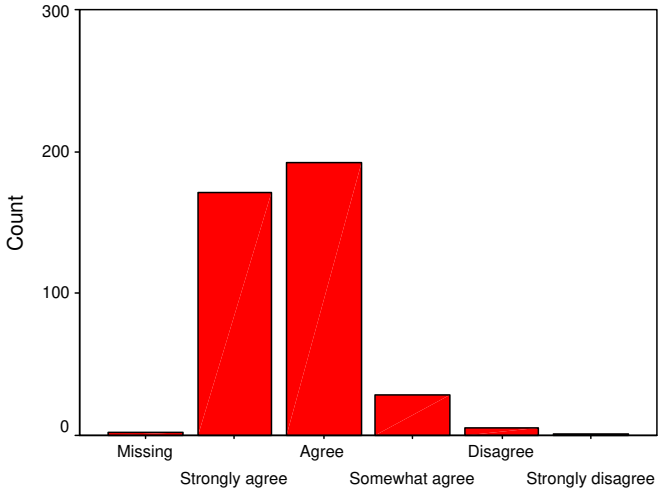
	Frequency	Percent
Yes	360	90.0
No	36	9.0
Subtotal	396	99.0
Missing	4	1.0
Total	400	100.0

21. On average, did your instructor ask questions of the students to see if his/her lecture points were understood during the courses you attended?

	Frequency	Percent
Yes	379	94.8
No	19	4.8
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0

22. The training I received regarding California's (Smog Check Program) laws and regulations was sufficient.

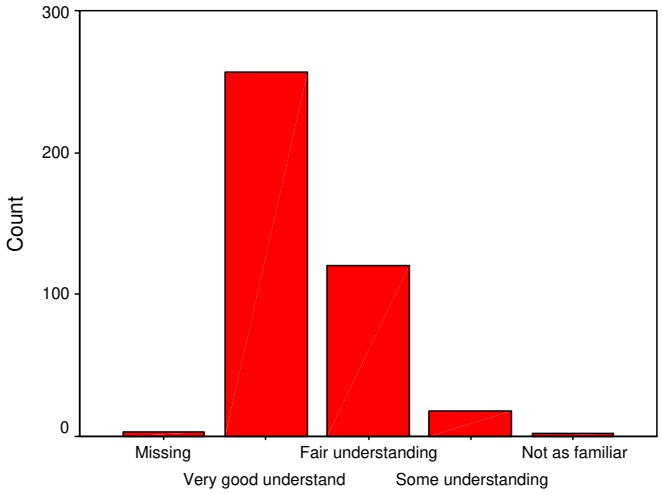
	Frequency	Percent
Strongly agree	171	42.8
Agree	192	48.0
Somewhat agree	29	7.3
Disagree	5	1.3
Strongly disagree	1	.3
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0



Q22 Training recd re Calif laws and regs was sufficient

23. How would you characterize your understanding of basic automotive electrical/electronic systems (e.g., wiring schematics, Ohms law, series/parallel circuits, DVOM usage, voltage drop testing, etc.)?

	Frequency	Percent
Very good understanding	257	64.3
Fair understanding	120	30.0
Some understanding	18	4.5
Not as familiar	2	.5
Subtotal	397	99.3
Missing	3	.8
Total	400	100.0



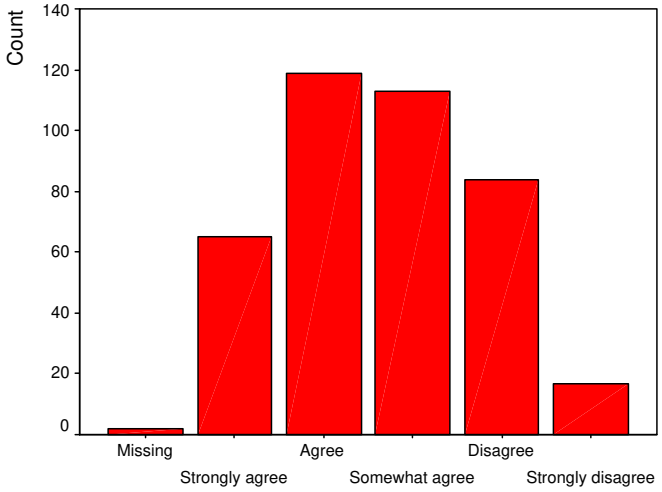
Q23 How would you char your underst of basic auto system

24. What additional training do you feel would have benefited you in your job performance? (Check all that apply)

Step-by-step diagnostic procedures to identify causes of emission failures	162
Theory and operation of CAN systems	137
Advanced scan tool usage	131
Application of Mode 6 information	128
On-Board Diagnostic (OBD) II Fuel EVAP systems theory, operation and testing	109
Fuel trim/adaptive strategy	105
Smog Check Program rules and regulations	93
Lambda calculations	90
How to conduct a Smog Check inspection	88
BAR-97 EIS usage	86
Theory and operation of Emission Control Systems (ECS)	69
Proper use of diagnostic repair manuals	67
Theory and operation of sensors and actuators	63
Basic electrical systems	53
Basic engine theory and testing procedures	55
Theory and operation of ignition systems	56
Theory and operation of fuel systems	52

25. Additional training modules are necessary to prepare me to perform emission-related diagnosis and repairs.

	Frequency	Percent
Strongly agree	65	16.3
Agree	119	29.8
Somewhat agree	113	28.3
Disagree	84	21.0
Strongly disagree	17	4.3
Subtotal	398	99.5
Missing	2	.5
Total	400	100.0



Q25 Additional trng modules necessary

26. Have you participated in non-BAR training courses that used the Internet for teaching purposes?

	Frequency	Percent
Yes	95	23.8
No	304	76.0
Subtotal	399	99.8
Missing	1	.3
Total	400	100.0

27. Did your non-BAR training courses use the Internet for "distance learning" outside of the classroom setting?

	Frequency	Percent
Yes	81	20.3
No	271	67.8
Subtotal	352	88.0
Missing	48	12.0
Total	400	100.0

28. Which of the following age groups best describes your current age?

	Frequency	Percent
18 to 24 years	84	21.0
25 to 34 years	126	31.5
35 to 50 years	141	35.3
51 years and older	49	12.3
Total	400	100.0

APPENDIX C: OWNER/SUPERVISOR ASSESSMENT

1. What type of facility is your station? (Check all that apply)

Test-only	157
Test and Repair	246
Gold Shield	50
Private fleets (as designated by BAR)	2

2. How many years has your facility been performing Smog Check inspections?

	Frequency	Percent
Less than 1 yr	25	5.6
1 to 5 yrs	135	30.2
6 to 9 yrs	75	16.8
10 to 20 yrs	147	32.9
More than 20 yrs	65	14.5
Total	447	100.0

3. How many Smog Check technicians have you employed over the last year?

	Frequency	Percent
Just myself	227	50.8
1 to 2 technicians	181	40.5
3 to 5 technicians	32	7.2
6 or more technicians	7	1.6
Total	447	100.0

4. If your facility repairs vehicles, approximately how many Smog Check repairs does your facility perform monthly?

	Frequency	Percent
Does not apply	155	34.7
1 to 3 repairs	75	16.8
4 to 7 repairs	81	18.1
8 to 12 repairs	57	12.8
13 or more repairs	79	17.7
Total	447	100.0

5. Does your station have a computer that technicians actively use to access the Internet so they can obtain information from manufacturer websites or online resources (e.g., Mitchell-On-Demand, AllData, etc.)?

	Frequency	Percent
Yes	340	76.1
No	107	23.9
Total	447	100.0

6. For each of the following, mark an "X" under either "Strong" or "Weak" to indicate whether you believe the Smog Check technician(s) at your facility have a relatively strong or weak understanding of each knowledge area.

"Strong" indicates technician has competency in this area

"Weak" indicates more training may be needed.

"Does Not Apply" indicates a knowledge area does not apply to the work at the respondents' facility

Knowledge Area	Strong	Weak	Does Not Apply
Electrical/electronic system theory, operation, diagnosis and repair	321	43	83
Engine theory and testing procedures	376	16	55
Engine performance	373	19	55
Theory, operations, and identification of Emission Control Systems (ECS)	412	18	17
Proper use of diagnostic repair manuals	345	25	77
On-Board Diagnostic (OBD) II theory, operation and testing	361	39	47
Scan tool usage	337	47	63
Acceleration Simulation Mode (ASM) testing	396	15	36
Two-speed idle (TSI) testing	433	8	6
Gauging stoichiometry to diagnose emission failures (Lambda calculator, fuel trim data, stoichiometric chart, 5-gas analysis)	260	94	93
Smog Check Program Rules and Regulations	402	40	5

APPENDIX D: TECHNICIAN NEEDS ASSESSMENT

1. **Where did you obtain your BAR training? (Check all that apply)**

Private vocational school	40
Community college	46
Occupational center	13
Regional Opportunity Program (ROP)	1
Other	9

2. **Where did you obtain the greatest amount of experience in emission-related (Smog Check) inspections and/or repairs?**

	Frequency	Percent
At a test-only station	2	2.4
Licensed Test and Repair facility including Gold Shield	76	89.4
Licensed fleet facility	2	2.4
Not currently employed in auto repair field	1	1.2
Other	4	4.7
Total	85	100.0

3. **How many years have you been a licensed Smog Check Technician?**

	Frequency	Percent
1 to 5 yrs	7	8.2
6 to 10 yrs	12	14.1
11 or more yrs	65	76.5
Not a Smog Check Technician	1	1.2
Total	85	100.0

4. **What National Institute of Automotive Service Excellence (ASE) certifications do you hold? (Check all that apply. Do not include the BAR ASE Alternative courses.)**

Certification	
Automotive Electrical/Electronic systems (A6)	72
Automotive Engine Performance (A8)	75
Automotive Advanced Engine Performance Specialist (L1)	67
None	7
Other	36

5. How much automotive trade experience did you have <u>prior</u> to starting your first BAR course?

	Frequency	Percent
No automotive trade experience	7	8.2
6 mo to 1 yr	1	1.2
1 to 2 yrs	11	12.9
2 to 5 yrs	20	23.5
More than 5 yrs	46	54.1
Total	85	100.0

6. How many automotive training courses did you complete <u>prior</u> to starting your first BAR course?

	Frequency	Percent
No auto courses prior to first BAR course	20	23.5
1 to 2 courses	8	9.4
3 courses	9	10.6
4 courses	12	14.1
5 courses	5	5.9
More than 5 courses	31	36.5
Total	85	100.0

7. Which of the following BAR ASE Alternative courses, if any, have you completed? (Check all that apply)

Course	
Automotive Electrical/Electronic systems (A6 alternative)	33
Automotive Engine Performance (A8 alternative)	31
Automotive Advanced Engine Performance Specialist (L1 alternative)	46
None	37

Rating scale

When should a technician, new to Smog Check, acquire competence in this task?

0 - Not part of my job
1 - During industry experience before licensure
2 - During required coursework and/or training before licensure
3 - During industry experience after licensure
4 - During BAR update training or other training after licensure

Ratings of commonly performed tasks

Item		When Acquired[3]
	I. Consumer Consultation	
T10.	Inform consumer of available assistance programs in event of inspection failure.	2.45
T5.	Inform the consumer of vehicle smog check results by explaining the vehicle inspection report (VIR) to the consumer.	2.44
T9.	Inform consumer of need for retest following repairs made to vehicle.	2.27
T8.	Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.	2.14
T7.	Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.	2.12
T1.	Determine type of smog check inspection to be performed on vehicle (e.g., initial registration, renew registration, change of ownership, test-only).	2.09
T4.	Inform consumer of the option for an official pretest smog check inspection.	2.00
T6.	Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.	1.98
T2.	Determine if vehicle requires a smog check by evaluating vehicle information prior to performing smog check inspection.	1.95
T3.	Prepare work order to document smog check inspection to be performed and obtain consumer authorization.	1.94
	II. Vehicle Inspection	
T13.	Determine if vehicle is required to be tested at a specific type of station (e.g., referee, Gold Shield).	2.34

[3] Assumes a cutoff value of 2.5 on a four-point rating scale (1= during industry experience before licensure, 2 = during required coursework before licensure, 3 = during industry experience after licensure, and 4 = during BAR Update training or other training after licensure).

Item		When Acquired[3]
T14.	Determine type of vehicle certification to evaluate vehicle emission label (e.g., California, Federal, BAR label).	2.30
T11.	Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number).	2.22
T12.	Evaluate vehicle emission label to determine vehicle emission control requirements.	2.21
	III. Safety Precautions	
T19.	Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.	2.35
T20.	Secure vehicle during emissions inspection (e.g., two speed idle) by setting the emergency brake or chocks.	2.26
T18.	Follow recommended safety procedures of vehicle and equipment manufacturers while servicing vehicle (e.g., inspection, diagnosis, repair).	2.06
T15.	Determine if minor repairs need to be performed on vehicle to ensure safety during smog check inspection (e.g., loose hose clamp, tire conditions).	2.05
T17.	Maintain safety of testing area by keeping area clean.	1.99
T16.	Perform minor repairs on vehicle if needed during safety inspection (e.g., tighten loose hose clamp).	1.95
	IV. Calibration of Analyzer and Devices	
T25.	Perform troubleshooting procedures on evaporative pressure test (LPEFT) equipment to restore correct function.	2.62
T22.	Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed.	2.52
T26.	Inspect dynamometer to ensure safe operation prior to performing calibration.	2.49
T21.	Perform calibration of emissions testing equipment to ensure accurate functioning during smog check inspection.	2.47
T23.	Perform troubleshooting procedures on analyzer sample system to restore correct function.	2.47
T24.	Perform troubleshooting procedures on fuel cap test devices to restore correct function.	2.44
T27.	Perform troubleshooting procedures on dynamometer to restore correct function.	2.36
	V. Emission Test Procedures	
T37.	Perform acceleration simulation mode (ASM) test as prompted by analyzer to measure vehicle emissions.	2.58
T33.	Perform two speed idle (TSI) test if prompted by analyzer.	2.57
T34.	Remove analyzer devices from vehicle following emission inspection as prompted by analyzer.	2.57

Item		When Acquired[3]
T30.	Enter technician access code into analyzer to validate technician authorization.	2.55
T31.	Prepare for emissions inspection by following analyzer prompts (e.g., insert probe, attach RPM pickup, enter vehicle information, restrain vehicle, cooling fan).	2.51
T32.	Perform pretest smog check inspection on vehicle if authorized by consumer.	2.51
T35.	Determine placement of vehicle on dynamometer prior to performing emission inspection (e.g., front wheel drive, rear wheel drive).	2.51
T29.	Select vehicle gear as prompted by the analyzer during emissions testing.	2.50
T36.	Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer.	2.48
T28.	Prepare vehicle for emission inspection by warming engine to normal operating temperature prior to performing emission inspection.	2.33
	VI. Visual Inspection	
T50.	Perform visual inspection of vehicle to determine presence of excessive smoke (e.g., tailpipe, crankcase).	2.51
T49.	Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.	2.39
T43.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of fuel evaporative (EVAP) system on vehicle.	2.33
T41.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of thermostatic air cleaner (TAC) system on vehicle.	2.32
T38.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of positive crankcase ventilation (PCV) system on vehicle.	2.29
T40.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of exhaust gas recirculation (EGR) system on vehicle.	2.27
T42.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of air injection (AIS) system on vehicle.	2.27
T46.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.	2.27
T39.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of catalytic converter system on vehicle.	2.26
T44.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control systems on vehicle.	2.26

Item		When Acquired[3]
T47.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of sensors, switches, and computers on vehicle.	2.26
T48.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of other emission-related components on vehicle.	2.25
T45.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.	2.24
	VII. Functional Tests	
T57.	Perform evaporative pressure test as required.	2.59
T52.	Perform OBD II test as prompted by the analyzer.	2.44
T56.	Perform functional test of fuel cap as prompted by the analyzer.	2.39
T55.	Perform functional test of the fillpipe restrictors when prompted by the analyzer.	2.27
T54.	Perform functional test of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.	2.24
T51.	Perform functional test of vehicle's malfunction indicator light (MIL) as prompted by the analyzer.	2.18
T53.	Perform ignition timing check as prompted by the analyzer by following manufacturer procedures.	2.14
	VIII. Diagnosis	
T59.	Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to diagnosing failure.	2.55
T60.	Inspect vehicle emission systems to determine if failure was due to physical condition of systems.	2.45
T58.	Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.	2.44
T63.	Evaluate diagnostic readings to determine if a system failure may be causing other systems to fail.	2.42
T62.	Perform diagnostic testing on vehicle systems as indicated by failure analysis.	2.39
T61.	Evaluate emissions results (e.g., excessive HC, excessive CO) to identify systems in vehicle that need diagnostic testing.	2.36
	IX. Performing and Verifying Repairs	
T66.	Perform pre-inspection prior to retest to verify that repair is successful.	2.55
T64.	Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced.	2.52

Item		When Acquired[3]
T65.	Replace, repair or clean out components of vehicle systems as indicated by vehicle diagnosis.	2.47

APPENDIX E: KNOWLEDGE BASE

K1.	Knowledge of procedures performed during smog check inspection.
K2.	Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
K3.	Knowledge base used to obtain information from consumers regarding type of smog check inspection needed.
K4.	Knowledge of information required to determine if a vehicle requires smog check inspection.
K5.	Knowledge of laws and regulations requiring vehicles to be tested at a test-only station.
K6.	Knowledge of procedures used to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution).
K7.	Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
K8.	Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection.
K9.	Knowledge of purposes for referring consumers to referee stations (e.g., engine change, SPCNS).
K10.	Knowledge of required information used to prepare work orders for smog check inspection.
K11.	Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
K12.	Knowledge of reasons for informing consumers about the option of a pretest smog check inspection.
K13.	Knowledge of required procedures if a consumer wants pretest smog check inspection.
K14.	Knowledge of type of information provided in vehicle inspection report (VIR).
K15.	Knowledge of purpose for providing consumer with vehicle inspection report (VIR).
K16.	Knowledge of types of repairs that can be considered minor repairs.
K17.	Knowledge of procedures used to determine if vehicle needs minor repairs before performing smog check inspection.

K18.	Knowledge of laws and regulations regarding performing minor repairs on vehicles.
K19.	Knowledge of purposes for performing minor repairs on vehicles.
K20.	Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).
K21.	Knowledge of procedures used to assist consumer in understanding the vehicle inspection report (VIR).
K22.	Knowledge of information provided to consumers about retesting a vehicle following repairs.
K23.	Knowledge of methods used to determine if smog check inspection of a vehicle needs to be performed at test-only station.
K24.	Knowledge of methods used to determine if vehicle repairs are covered under warranty.
K25.	Knowledge of information necessary to inform consumer of possible warranty coverage.
K26.	Knowledge of laws and regulations about performing diagnostic testing on vehicles.
K27.	Knowledge of purposes for performing diagnostic testing on vehicles.
K28.	Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles.
K29.	Knowledge of procedures used to recommend vehicle repairs to consumers.
K30.	Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates.
K31.	Knowledge of laws and regulations regarding performing repairs on vehicles.
K32.	Knowledge of laws and regulations requiring consumer authorization for performing repairs on vehicles.
K33.	Knowledge of purpose for performing retest on a vehicle following repairs.
K34.	Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles.
K35.	Knowledge of purposes for reviewing DMV renewal notices.
K36.	Knowledge of procedures used to verify vehicle information prior to performing smog check inspection.

K37.	Knowledge of information used to determine type of vehicle certification (e.g., California, Federal, BAR label).
K38.	Knowledge of information to provide to consumers when vehicle does not conform to emissions certifications (i.e., Gray Market).
K39.	Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, Gold Shield).
K40.	Knowledge of references used to identify a vehicle that does not have an emissions label.
K41.	Knowledge of purposes for verifying vehicle safety prior to performing smog check inspection.
K42.	Knowledge of procedures used to identify unsafe vehicle conditions.
K43.	Knowledge of information to provide consumers about unsafe vehicle condition(s).
K44.	Knowledge base used to differentiate between minor and major vehicle repairs.
K45.	Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.
K46.	Knowledge of informing consumers of minor repairs that needed to be made to vehicle.
K47.	Knowledge of purposes for performing minor repairs to a vehicle during safety check.
K48.	Knowledge of procedures used to perform minor repairs to a vehicle.
K49.	Knowledge of laws and regulations about stations performing minor repairs on vehicles to ensure safe test conditions.
K50.	Knowledge of types of references used to assist a technician in performing minor repairs to a vehicle.
K51.	Knowledge of regulations requiring clean inspection area.
K52.	Knowledge of types of equipment used during smog check inspection that could harm consumer, staff, and technician.
K53.	Knowledge of procedures used to operate equipment during smog check inspection.
K54.	Knowledge of references used to inform technician of equipment operation.

K55.	Knowledge of vehicle problems leading to smog check inspection being aborted.
K56.	Knowledge of methods used to verify function of fuel cap test device(s).
K57.	Knowledge of procedures used to calibrate fuel cap test device(s).
K58.	Knowledge of methods used to verify function of analyzer component(s) (i.e., RPM, probe).
K59.	Knowledge of types of analyzer components(s) (i.e., RPM, probe) used during smog check inspection.
K60.	Knowledge of procedures used to inspect and maintain analyzer maintenance components.
K61.	Knowledge of procedures used to troubleshoot analyzer system.
K62.	Knowledge of types of references used by technician to troubleshoot analyzer system.
K63.	Knowledge of references and procedures used to troubleshoot fuel cap integrity test device(s).
K64.	Knowledge of methods used to troubleshoot on-line phone connection.
K65.	Knowledge of methods used to verify operation of dynamometer.
K66.	Knowledge of components of a dynamometer.
K67.	Knowledge of references and procedures used to troubleshoot dynamometer.
K68.	Knowledge of procedures used to prepare vehicle for performing an emissions test.
K69.	Knowledge of purposes for warming vehicle engine prior to performing an emissions inspection.
K70.	Knowledge of procedures used to secure vehicle while performing a two-speed idle test.
K71.	Knowledge base used to validate technician access to EIS to perform smog check inspection.
K72.	Knowledge for verifying weight classification of vehicle.
K73.	Knowledge of procedures used to enter vehicle information.
K74.	Knowledge of type of vehicle information used to prepare for an emissions inspection.

K75.	Knowledge of device(s) used to sample vehicle exhaust system.
K76.	Knowledge of device(s) used to detect engine rpm.
K77.	Knowledge of purposes and procedures for performing pretest smog check inspection.
K78.	Knowledge of procedures used to perform two-speed idle (TSI) test.
K79.	Knowledge of procedures used following the completion of emission inspection.
K80.	Knowledge of equipment used to prevent vehicle from overheating during an acceleration simulation mode (ASM) test.
K81.	Knowledge of proper placement of vehicle on dynamometer.
K82.	Knowledge of procedures and purpose used to place and secure vehicle onto dynamometer.
K83.	Knowledge of types of equipment used to secure vehicle onto dynamometer.
K84.	Knowledge of procedures used to weigh vehicle on dynamometer.
K85.	Knowledge of procedures used to perform acceleration simulation mode (ASM) test.
K86.	Knowledge of procedures used to keep vehicle speed stabilized during acceleration simulation mode (ASM) test.
K87.	Knowledge of methods used to evaluate installation of positive crankcase ventilation (PCV) system.
K88.	Knowledge of methods used to verify condition of required hoses in positive crankcase ventilation (PCV) system.
K89.	Knowledge of types of references used to identify components of the positive crankcase ventilation (PCV) system.
K90.	Knowledge of methods used to evaluate installation of catalytic converter system.
K91.	Knowledge of types of external damage caused to catalytic converter system.
K92.	Knowledge of methods used to evaluate installation of exhaust gas recirculation (EGR) system.
K93.	Knowledge of methods used to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.

K94.	Knowledge of methods used to verify condition of pressure transducers in exhaust gas recirculation (EGR) system.
K95.	Knowledge of methods used to verify condition of speed switches in exhaust gas recirculation (EGR) system.
K96.	Knowledge of methods used to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.
K97.	Knowledge of methods used to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.
K98.	Knowledge of methods used to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.
K99.	Knowledge of types of references used to identify components of the exhaust gas recirculation (EGR) system.
K100.	Knowledge base used to evaluate installation and components of thermostatic air cleaner (TAC) system.
K101.	Knowledge base used to verify condition of heat delivery pipes and heat stoves in thermostatic air cleaner (TAC) system.
K102.	Knowledge base used to verify condition of thermal vacuum switches and vacuum hoses in thermostatic air cleaner (TAC) system.
K103.	Knowledge of reference materials used to identify components of the thermostatic air cleaner (TAC) system.
K104.	Knowledge base used to evaluate installation and conditions of components of air injection (AIS) system.
K105.	Knowledge base used to verify condition of air pump in air injection (AIS) system.
K106.	Knowledge base used to verify condition of valve(s) in air injection (AIS) system.
K107.	Knowledge base used to verify condition of electrical components in air injection (AIS) system.
K108.	Knowledge base used to verify condition of vacuum signal lines in air injection (AIS) system.
K109.	Knowledge base used to verify routing of distribution hoses in air injection (AIS) system.

K110.	Knowledge of reference materials used to identify components of the air injection (AIS) system.
K111.	Knowledge base used to evaluate installation and condition of components of fuel evaporative (EVAP) system.
K112.	Knowledge base used to verify condition of vapor storage canister in fuel evaporative (EVAP) system.
K113.	Knowledge base used to verify condition of hoses in fuel evaporative (EVAP) system.
K114.	Knowledge base used to verify condition of solenoids in fuel evaporative (EVAP) system.
K115.	Knowledge base used to determine the type of fuel tank cap in fuel evaporative (EVAP) system.
K116.	Knowledge base used to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system.
K117.	Knowledge of reference materials used to identify components of the fuel evaporative (EVAP) system.
K118.	Knowledge base used to evaluate installation of ignition spark control system(s).
K119.	Knowledge of components used in the ignition spark control system(s).
K120.	Knowledge base used to verify condition of thermal vacuum switches in ignition spark control system(s).
K121.	Knowledge base used to verify condition of TCS switches in ignition spark control system(s).
K122.	Knowledge base used to verify condition of sensors in ignition spark control system(s).
K123.	Knowledge base used to verify condition of spark delay valves in ignition spark control system(s).
K124.	Knowledge of reference materials used to identify components of the ignition spark control system(s).
K125.	Knowledge base used to evaluate installation of fuel induction system.
K126.	Knowledge of components used in the fuel induction system.
K127.	Knowledge base used to verify condition of hoses and lines used in the fuel induction system.

K128.	Knowledge base used to verify condition of wiring in fuel induction system.
K129.	Knowledge base used to verify condition of carburetor in fuel induction system.
K130.	Knowledge base used to verify condition of fuel injection system.
K131.	Knowledge of reference materials used to identify components of the fuel induction system.
K132.	Knowledge base used to identify liquid fuel leaks.
K133.	Knowledge base used to evaluate installation and condition of sensors, switches, and computers.
K134.	Knowledge of types of sensors, switches, and computers in vehicle.
K135.	Knowledge base used to verify condition of wiring.
K136.	Knowledge of reference materials used to identify sensors, switches, and computers of vehicle.
K137.	Knowledge base used to identify installation and condition of other vehicle emission related components.
K138.	Knowledge of reference materials used to identify other vehicle emissions related components that are permitted.
K139.	Knowledge of purposes for verifying emission components of a vehicle.
K140.	Knowledge of reference materials used to identify required emission controlled components of a vehicle.
K141.	Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.
K142.	Knowledge of reference materials used to identify approved substitute emission components (e.g., CARB, Appendix K).
K143.	Knowledge base used to verify function of malfunction indicator light (MIL).
K144.	Knowledge of purpose and procedures for performing OBD II functional test.
K145.	Knowledge of procedures used to verify vehicle ignition timing.
K146.	Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.
K147.	Knowledge of vehicles that are exempt from ignition timing functional test.
K148.	Knowledge of purposes for performing ignition timing functional test.

K149.	Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.
K150.	Knowledge of purpose and procedures used to verify function of exhaust gas recirculation (EGR) system.
K151.	Knowledge base used to verify function of fillpipe restrictors.
K152.	Knowledge base used to perform fuel cap functional test.
K153.	Knowledge of vehicles that require fuel cap functional test.
K154.	Knowledge for performing fuel cap functional test.
K155.	Knowledge base used to identify areas of failure on vehicle inspection report (VIR).
K156.	Knowledge base used to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems.
K157.	Knowledge base used to interpret vehicle inspection report (VIR) results.
K158.	Knowledge of purposes and procedures used to perform a baseline test prior to diagnosing a vehicle.
K159.	Knowledge of oxides of nitrogen (NOx) emission levels.
K160.	Knowledge of carbon dioxide (CO2) emission levels.
K161.	Knowledge of carbon monoxide (CO) emission levels.
K162.	Knowledge of oxygen (O2) emission levels.
K163.	Knowledge of hydrocarbon (HC) emission levels.
K164.	Knowledge of emissions that are considered hazardous.
K165.	Knowledge base used to verify condition of vehicle positive crankcase ventilation (PCV) system.
K166.	Knowledge base used to verify condition of vehicle catalytic converter system.
K167.	Knowledge base used to verify condition of vehicle exhaust gas recirculation (EGR) system.
K168.	Knowledge base used to verify condition of vehicle thermostatic air cleaner (TAC) system.
K169.	Knowledge base used to verify condition of vehicle air injection (AIS) system.
K170.	Knowledge base used to verify condition of vehicle evaporative (EVAP) system.

K171.	Knowledge base used to verify condition of vehicle ignition spark control system(s).
K172.	Knowledge base used to verify condition of vehicle fuel induction system.
K173.	Knowledge base used to verify condition of vehicle sensors, switches, and computers.
K174.	Knowledge base used to verify condition of other related emissions components.
K175.	Knowledge of components of vehicle systems that may have been tampered.
K176.	Knowledge of components of vehicle systems that may have been damaged.
K177.	Knowledge of reference materials used to verify vehicle systems condition.
K178.	Knowledge of procedures used to diagnose positive crankcase ventilation (PCV) system.
K179.	Knowledge of procedures used to diagnose catalytic converter system.
K180.	Knowledge of procedures used to diagnose exhaust gas recirculation (EGR) system.
K181.	Knowledge of procedures used to diagnose thermostatic air cleaner (TAC) system.
K182.	Knowledge of procedures used to diagnose air injection (AIS) system.
K183.	Knowledge of procedures used to diagnose evaporative (EVAP) system.
K184.	Knowledge of procedures used to diagnose ignition spark control system(s).
K185.	Knowledge of procedures used to diagnose fuel induction system.
K186.	Knowledge of procedures used to diagnose sensors, switches, and computers.
K187.	Knowledge of procedures used to diagnose other related emissions components.
K188.	Knowledge of procedures used to perform onboard diagnostic testing.
K189.	Knowledge of reference materials used when performing diagnostic testing on a vehicle.
K190.	Knowledge of information from diagnostic testing results indicating vehicle system failures that affect other systems.
K191.	Knowledge of relationships between vehicle systems.

K192.	Knowledge of procedures and reference material used to interpret diagnostic readings.
K193.	Knowledge of equipment used to perform diagnostic testing procedures.
K194.	Knowledge of procedures used to determine type of vehicle repair to be performed.
K195.	Knowledge of procedures and equipment used to determine if components need to be cleaned, repaired, or replaced.
K196.	Knowledge of procedures used to repair vehicle emission systems.
K197.	Knowledge of components of positive crankcase ventilation (PCV) system that need repair.
K198.	Knowledge of components of catalytic converter system that need repair.
K199.	Knowledge of components of exhaust gas recirculation (EGR) system that need repair.
K200.	Knowledge of components of thermostatic air cleaner (TAC) system that need repair.
K201.	Knowledge of components of air injection (AIS) system that need repair.
K202.	Knowledge of components of evaporative (EVAP) system that need repair.
K203.	Knowledge of components of ignition spark control system(s) that need repair.
K204.	Knowledge of components of fuel induction system that need repair.
K205.	Knowledge of components of sensors, switches, and computers that need repair.
K206.	Knowledge of other related vehicle components that need repair.
K207.	Knowledge of types of equipment used to repair vehicle system(s).
K208.	Knowledge of components of positive crankcase ventilation (PCV) system that need replacement.
K209.	Knowledge of components of catalytic converter system that need replacement.
K210.	Knowledge of components of exhaust gas recirculation (EGR) system that need replacement.
K211.	Knowledge of components of thermostatic air cleaner (TAC) system that need replacement.

K212.	Knowledge of components of air injection (AIS) system need replacement.
K213.	Knowledge of components of evaporative (EVAP) system that need replacement.
K214.	Knowledge of components of ignition spark control system(s) that need replacement.
K215.	Knowledge of components of fuel induction system that need replacement.
K216.	Knowledge of components of sensors, switches, and computers that need replacement.
K217.	Knowledge of other related vehicle components that need replacement.
K218.	Knowledge base used to verify vehicle systems repairs.
K219.	Knowledge of purposes and procedures for performing an “after repair” smog check inspection.

APPENDIX F: TASK RATINGS – PRIOR TO LICENSURE

In the needs assessment survey (Survey #4), technicians indicated that competency in the majority of the tasks were acquired during industry experience or during required coursework/training before licensure. The findings assist in identifying tasks that technicians would acquire competency during industry training before licensure (Rating = 1) and tasks that technicians would acquire competency during required coursework before licensure (Rating = 2). Tasks with ratings of 1 – 2.5 would be appropriate to include in training before licensure.

Therefore, tasks to be included in prelicensure training are:

Item		When Acquired[4]
T29.	Select vehicle gear as prompted by the analyzer during emissions testing.	2.50
T26.	Inspect dynamometer to ensure safe operation prior to performing calibration.	2.49
T36.	Weigh vehicle as prompted by the emissions analyzer to set load of dynamometer.	2.48
T21.	Perform calibration of emissions testing equipment to ensure accurate functioning during smog check inspection.	2.47
T23.	Perform troubleshooting procedures on analyzer sample system to restore correct function.	2.47
T65.	Replace, repair or clean out components of vehicle systems as indicated by vehicle diagnosis.	2.47
T10.	Inform consumer of available assistance programs in event of inspection failure.	2.45
T60.	Inspect vehicle emission systems to determine if failure was due to physical condition of systems.	2.45
T5.	Inform the consumer of vehicle smog check results by explaining the vehicle inspection report (VIR) to the consumer.	2.44
T24.	Perform troubleshooting procedures on fuel cap test devices to restore correct function.	2.44
T52.	Perform OBD II test as prompted by the analyzer.	2.44
T58.	Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.	2.44
T63.	Evaluate diagnostic readings to determine if a system failure may be causing other systems to fail.	2.42
T49.	Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.	2.39
T56.	Perform functional test of fuel cap as prompted by the analyzer.	2.39
T62.	Perform diagnostic testing on vehicle systems as indicated by failure analysis.	2.39

[4] Assumes a cutoff value of 2.5 on a four-point rating scale

Item		When Acquired[4]
T27.	Perform troubleshooting procedures on dynamometer to restore correct function.	2.36
T61.	Evaluate emissions results (e.g., excessive HC, excessive CO) to identify systems in vehicle that need diagnostic testing.	2.36
T19.	Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.	2.35
T13.	Determine if vehicle is required to be tested at a specific type of station (e.g., referee, Gold Shield).	2.34
T28.	Prepare vehicle for emission inspection by warming engine to normal operating temperature prior to performing emission inspection.	2.33
T43.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of fuel evaporative (EVAP) system on vehicle.	2.33
T41.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of thermostatic air cleaner (TAC) system on vehicle.	2.32
T14.	Determine type of vehicle certification to evaluate vehicle emission label (e.g., California, Federal, BAR label).	2.30
T38.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of positive crankcase ventilation (PCV) system on vehicle.	2.29
T9.	Inform consumer of need for retest following repairs made to vehicle.	2.27
T40.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of exhaust gas recirculation (EGR) system on vehicle.	2.27
T42.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of air injection (AIS) system on vehicle.	2.27
T46.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.	2.27
T55.	Perform functional test of the fillpipe restrictors when prompted by the analyzer.	2.27
T20.	Secure vehicle during emissions inspection (e.g., two-speed idle) by setting the emergency brake or chocks.	2.26
T39.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of catalytic converter system on vehicle.	2.26
T44.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control systems on vehicle.	2.26

Item		When Acquired[4]
T47.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of sensors, switches, and computers on vehicle.	2.26
T48.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation and condition of other emission-related components on vehicle.	2.25
T45.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.	2.24
T54.	Perform functional test of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.	2.24
T11.	Determine accuracy of DMV renewal notice and vehicle information prior to performing smog check inspection (e.g., VIN label, license number).	2.22
T12.	Evaluate vehicle emission label to determine vehicle emission control requirements.	2.21
T51.	Perform functional test of vehicle's malfunction indicator light (MIL) as prompted by the analyzer.	2.18
T8.	Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.	2.14
T53.	Perform ignition timing check as prompted by the analyzer by following manufacturer procedures.	2.14
T7.	Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.	2.12
T1.	Determine type of smog check inspection to be performed on vehicle (e.g., initial registration, renew registration, change of ownership, test-only).	2.09
T18.	Follow recommended safety procedures of vehicle and equipment manufacturers while servicing vehicle (e.g., inspection, diagnosis, repair).	2.06
T15.	Determine if minor repairs need to be performed on vehicle to ensure safety during smog check inspection (e.g., loose hose clamp, tire conditions).	2.05
T4.	Inform consumer of the option for an official pretest smog check inspection.	2.00
T17.	Maintain safety of testing area by keeping area clean.	1.99
T6.	Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.	1.98
T2.	Determine if vehicle requires a smog check by evaluating vehicle information prior to performing smog check inspection.	1.95

Item		When Acquired[4]
T16.	Perform minor repairs on vehicle if needed during safety inspection (e.g., tighten loose hose clamp).	1.95
T3.	Prepare work order to document smog check inspection to be performed and obtain consumer authorization.	1.94

APPENDIX G: TASK RATINGS – AFTER LICENSURE

In the needs assessment survey, the findings can assist in identifying tasks that technicians would acquire competency during industry training before licensure (Rating = 1) and tasks that technicians would acquire competency during required coursework before licensure (Rating = 2). Tasks with an average rating greater than 2.5 would indicate that tasks would be appropriate to include in update or other post licensure training (where Rating = 3 if task competency is acquired during industry experience after licensure; Rating = 4 if task competency is acquired during update training).

Therefore tasks to be included in post licensure training were:

Item		When Acquired[5]
T25.	Perform troubleshooting procedures on evaporative pressure test (LPEFT) equipment to restore correct function.	2.62
T57.	Perform evaporative pressure test as required.	2.59
T37.	Perform acceleration simulation mode (ASM) test as prompted by analyzer to measure vehicle emissions.	2.58
T33.	Perform two speed idle (TSI) test if prompted by analyzer.	2.57
T34.	Remove analyzer devices from vehicle following emission inspection as prompted by analyzer.	2.57
T30.	Enter technician access code into analyzer to validate technician authorization.	2.55
T59.	Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to diagnosing failure.	2.55
T66.	Perform pre-inspection prior to retest to verify that repair is successful.	2.55
T22.	Inspect analyzer devices to ensure accurate functioning during smog check inspection or replace if needed.	2.52
T64.	Evaluate diagnostic testing results to determine if components of vehicle systems need to be cleaned, repaired, or replaced.	2.52
T31.	Prepare for emissions inspection by following analyzer prompts (e.g., insert probe, attach RPM pickup, enter vehicle information, restrain vehicle, cooling fan).	2.51
T32.	Perform pretest smog check inspection on vehicle if authorized by consumer.	2.51
T35.	Determine placement of vehicle on dynamometer prior to performing emission inspection (e.g., front wheel drive, rear wheel drive).	2.51
T50.	Perform visual inspection of vehicle to determine presence of excessive smoke (e.g., tailpipe, crankcase).	2.51

[5] Assumes a cutoff value of 2.5 on a four-point scale.

APPENDIX H: TRENDS IN ENROLLMENT AND PASS/FAIL RESULTS

Figure 6 – School success rate for Smog Check licensing examination 2/1/2001 – 12/12/2006

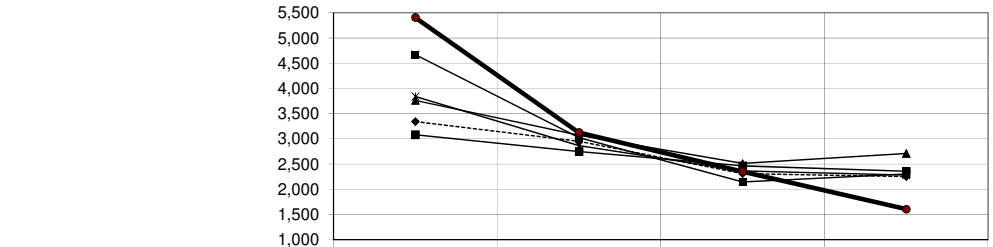
Organization		Exam Result			
		Fail		Pass	
	Total	#	%	#	%
California State and Community Colleges (public)	2333	578	24.8%	1755	75.2%
For-profit training institutions (private)	4132	1754	42.4%	2378	57.6%
Regional Occupational Programs, high schools, or adult education	426	192	45.1%	234	54.9%
BAR employees	19	1	5.3%	18	94.7%
Totals	6910	2525	36.5%	4385	63.5%

Figure 7 – Licensing examination trends for CY 2004 – 2007

Table 4 – Course enrollment in BAR courses for CY 2004 - 2007

Course Title	**CY 2004**	**CY 2005**	**CY 2006**	**CY 2007**
A6 - Engine Performance	3,342	2,951	2,309	2,253
A8 - Electrical/Electronic Systems	3,080	2,748	2,465	2,360
L1 - Advanced Engine Performance	3,762	3,073	2,514	2,710
CACC Basic	4,667	3,021	2,146	2,306
CACC Enhanced	3,837	2,863	2,361	2,281
Combined EA/EB License Exam	5,403	3,124	2,353	1,608

Figure 8 – Course enrollment and licensing examination trends for CY 2004 – 2007



	CY 2004	CY 2005	CY 2006	CY 2007
A6 - Engine Performance	3,342	2,951	2,309	2,253
A8 - Electrical/Electronic Systems	3,080	2,748	2,465	2,360
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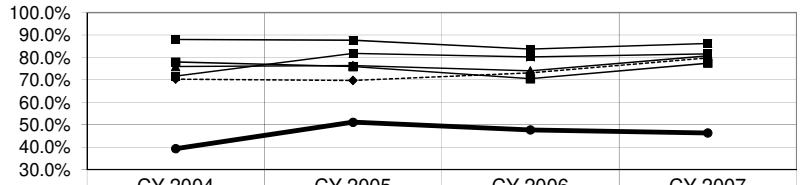
CACC Enhanced	3,837	2,863	2,361	2,281
Combined EA/EB License Exam	5,403	3,124	2,353	1,608

Figure 9 – Course and licensing pass rate trends for CY 2004 – 2007



	CY 2004	CY 2005	CY 2006	CY 2007
A6 - Engine Performance	70.3%	69.7%	73.2%	79.8%
A8 - Electrical/Electronic Systems	78.0%	76.0%	70.5%	77.5%
L1 - Advanced Engine Performance	76.0%	76.5%	74.1%	80.8%
CACC Basic	71.7%	81.9%	80.3%	81.7%
CACC Enhanced	88.1%	87.8%	83.7%	86.2%
Combined EA/EB License Exam	39.3%	51.1%	47.7%	46.3%

Attachment F

Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California

Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California

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February, 2009

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Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California

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Job Analysis Update for Basic and Advanced Smog Technicians for the Bureau of Automotive Repair, State of California

I. Executive Summary

The Bureau of Automotive Repair (BAR) of the State of California contracted with Donnoe & Associates, Inc. to conduct a job analysis study of the practice of Basic and Advanced Smog Technicians. This occupation was studied thoroughly by the State in 2001 and again in 2006 by the California Department of Consumer Affairs, Office of Professional Examinations Services (DCA/OPES). BAR requested that the current study use a tabletop/focus group methodology to revisit the 2006 study. This study was requested to ensure that the 2006 study was still current in light of recent changes in law and regulations. Additionally, the BAR expressed that the exam weights presented in the 2006 study represented a large shift from the 2001 study results and wished to have confirmation of appropriate weights.

In the current (2009) study, subject matter experts (SMEs) met in focus group workshops to review the lists of task and knowledge statements that had been developed for the 2006 study. In these focus group workshops a total of 14 of the existing 79 tasks were edited or changed. A total of seven new tasks were written, bring the total number of task statements to 86. For the knowledge statements, 209 of the original 270 were edited; two were moved to a different content area, 13 were deleted, and 10 new statements were generated. Following these edits, additions and deletions to these lists of tasks and knowledge, the SMEs rated tasks for 1) frequency of performance, 2) importance, and 3) relevance for determining minimum acceptable competence to function as a smog technician. The edited knowledge list was rated with 1) importance and 2) relevance ratings scales.

Both the task and knowledge statements were grouped into nine content areas in the 2001 and 2006 studies, and confirmed by the 2009 study. These nine content areas were analyzed for advanced and basic smog technicians working in test and repair stations. Seven of the content areas were analyzed for advanced and basic smog technicians working in test only stations (test only does not include the content areas for diagnosis and repair). For each content area test weights were developed from the task and knowledge analysis.

As a result of this analysis four new exam outlines were developed/validated, including:

1. Advanced Smog Technicians working in Test and Repair Stations (ATR).
2. Basic Smog Technicians working in Test and Repair Stations (BTR).
3. Advanced Smog Technicians working in Test Only Stations (ATO).
4. Basic Smog Technicians working in Test Only Stations (BTO).

The prior job analysis studies (of 2001 and 2006) described advanced smog technicians as working in “enhanced” areas, and basic smog technicians as working in “basic” areas. These designations of enhanced and basic areas are redundant with the titles of advanced or basic smog technicians. Further, these designations may not accurately reflect the work setting,

which is better described as being a test and repair station or a test only station – together with the license designation of advanced or basic. Enhanced areas include settings where a dynamometer is used in the testing process; basic areas do not have the dynamometer.

The exam weights by content area for each of the four exam outlines are summarized below, for both the 2006 study and the 2009 study.

Table 1. Exam Weights by Content Area and Exam Outlines: 2006 and 2009

	1. Advanced Technicians in Test & Repair Stations (ATR)		2. Basic Technicians in Test & Repair Stations (BTR)		3. Advanced Technicians in Test Only Stations (ATO)		4. Basic Technicians in Test Only Stations (BTO)	
Content Area	2006	2009	2006	2009	2006	2009	2006	2009
I.a Consumer Consultation	11%	9%	11%	10%	10%	15%	11%	1 6%
I.b Consumer * Consultation related to diagnosis and repairs	NA	7%	NA	8%	NA	NA	NA	NA
II. Vehicle Identification	6%	6%	7%	6%	7%	8%	8%	9%
III. Safety Precautions	9%	7%	9%	8%	10%	11%	13%	1 2%
IV. Calibration of Analyzer	8%	5%	7%	4%	10%	7%	9%	6%
V. Emission Test(s) Procedures	23%	15%	17%	10%	28%	21%	18%	1 5%
VI. Visual Inspection	19%	18%	22%	20%	24%	29%	28%	3 2%
VII. Functional Tests	9%	6%	11%	6%	11%	9%	13%	1 0%
VIII. Diagnosis	8%	16%	9%	16%	NA	NA	NA	NA
IX. Repairs	7%	11%	7%	12%	NA	NA	NA	NA

* The 2009 study separated consultation related to diagnosis and repair then included this with the overall diagnosis and repair exam plan, thereby increasing the relative weight of this part of the exams. Diagnosis and Repair content areas are highlighted.

Alternative Interpretation

An alternative model for considering the test specifications is to view this same data set from the perspective of Emissions Test work activities or Emissions Diagnosis and Repair work. This model has been discussed by BAR staff as a possible future direction for the Smog Technician occupational license. Were this the case, the present study still provides the test specification support needed for construction of content valid examinations. For example, such a reinterpretation of this data set could include one set of specifications based on the Emissions Test work function (test only), as shown in Table 1 for ATO and/or BTO. Then, the Diagnosis and Repair work function can be an independent exam element, with a separate passing score, and applied to the ATR and BTR work (ATR / BTR candidates would then take two exams; one for Emissions Testing and the next for Emissions Diagnosis and Repair). As an example, the BTR Diagnosis and Repair exam under this model would be divided into three subsections: 1) Consumer consultation related to test and repair; 22%; 2) Diagnosis, 45%; and 3) Repairs, 33%. Similarly the ATR Diagnosis and Repair exam under this model would be divided into the same three subsections, with slightly different weights – to account for the additional tasks and knowledge related to dynamometers: 1) Consumer consultation related to test and repair; 21%; 2) Diagnosis, 47%; and 3) Repairs, 32%.

A final breakdown of exam content would depend on new regulations. Once such regulations are in place, the 2009 test specifications can be reapportioned to account for changes without the need to conduct another occupational analysis study.

Discussion of Findings, in Relation to the 2006 Study

In the 2006 study, exam weights were derived entirely from task ratings; knowledge ratings were not considered. In the 2009 study both task ratings and knowledge ratings were equally considered in formulation of weights. This is an important methodological difference between these two studies, but this is not a criticism of the work completed by DCA's Office of Professional Examination Services.

The present study resulted in some new task and knowledge statements, but these are predominantly from changes in law since 2006. The present study also rewrote many existing task and knowledge statements. Yet, the 2006 study, comprised of a statewide survey is still a strong foundation for the 2009 occupational analysis update.

II. Job Analysis Methodology

Focus Group Method

Job analysis requires input from subject matter experts. This methodology for collecting and integrating SME input typically includes group discussions and job analysis questionnaires. Additionally, job analysis can include direct observation of work performed, but this technique is not a feasible approach for review of licensing work due to the diversity of work settings, geographic issues and large number of licensees.

The methodology used in the 2006 analysis began with small group discussion to identify task and knowledge statements. These statements were edited and organized, then assembled in a job analysis questionnaire. This questionnaire was completed by over 800 SMEs from throughout California. From this questionnaire analysis the 2006 exam outlines were constructed.

The methodology for the 2009 analysis also included group meetings with SMEs. This included a review and editing of task and knowledge statements from the 2006 analysis, then completion of a job analysis questionnaire by the same group of SMEs. This approach is referred to as a table-top or focus group approach.

For this focus group job analysis study, a group of 13 SMEs were recruited by BAR. All of these individuals were licensed Smog Technicians in California. Data on these individuals SMEs is available through BAR.

Job Analysis Workshops

Two job analysis workshops were completed: one on January 30, 2009 and the next on January 31, 2009. Both workshops were attended by the 13 SMEs and BAR staff, and were facilitated by William Donnoe and Michael Donnoe.

The agenda for *Workshop Number One* began with an overview of the purpose for the current study and the process and outcome of the 2006 study. Then, SMEs were presented with the complete listing of job tasks from the 2006 study. They were asked to individually review every task statement and make notes for discussion. When all SMEs had completed their individual review of the tasks, they were asked to systematically review all statements as a group and discuss and agree upon any edits, deletions and additions to this list. The focus was to arrive at a listing of job tasks that were all-inclusive, and fully described the work performed by Smog Technicians in California – including advanced, enhanced, basic, test-only, and test and repair work activities. SMEs were encouraged to edit the statements so that what was written made sense to them and could be used by another group of SMEs in test construction. Next, this process was repeated for all knowledge statements from the 2006 study. Again, any item to be edited, deleted or added to this list of knowledge statements was reviewed by the entire group and consensus was reached on final language.

Workshop Number Two began with a review of work completed in *Workshop Number One*. The final listings of tasks and knowledge are shown in Attachments 1 and 2. This reflects the edits that were completed prior to rating tasks and knowledge statements. Wording that is in a ~~strikeout format~~ was deleted by SMEs in the focus group workshops. Wording that is red and underlined represents new text or information. All final edits are shown. A total of 14 of the existing 79 tasks were edited or changed. A total of seven new tasks were written, bringing the total number of task statements to 86. For the knowledge statements, 209 of the original 270 were edited; two were moved to a different content area, 13 were deleted, and 10 new statements were generated – leaving 267 knowledge statements. Within Attachments 1 and 2 numbering of task or knowledge statements corresponds directly to numbering in the 2006 study, and as it was presented to SMEs in the focus groups for review and ratings. This is different than the final numbering that appears in the 2009 exam outlines.

After finalizing edits, SMEs in *Workshop Number Two* concentrated on rating the task and knowledge statements. Ratings were collected individually from SMEs in this focus group (i.e., individual, not consensus ratings). SMEs rated tasks for 1) frequency of performance, 2) importance, and 3) relevance for determining minimum acceptable competence to function as a smog technician. The edited knowledge list was rated with 1) importance and 2) relevance ratings scales. Prior to rating the task and knowledge statements SMEs thoroughly reviewed and discussed each of the rating scales and reached common agreement on how the scales were to be applied. In the 2006 analysis the focus of the rating scales was on the job performed by the individual SME respondents. In the current study SMEs were asked to consider tasks and knowledge for the profession – not just for themselves. This is a minor but important distinction.

Rating scales used in the task analysis are presented below in Figures 1, 2 and 3. Rating scales used to rate knowledge statements are shown in Figures 4 and 5.

Figure 1. Task Frequency Rating Scale

HOW OFTEN is this task performed by Smog Technicians?

0	DOES NOT APPLY TO THE SMOG TECHNICIAN JOB
1	RARELY. This is one of the least frequently performed tasks by Smog Technicians.
2	SELDOM. This task is performed infrequently relative to other tasks.
3	OCCASIONALLY. This task is performed somewhat frequently and is about average relative to all other tasks that Smog Technicians perform.
4	OFTEN. This task is performed more frequently than most other tasks.
5	VERY OFTEN. This task is performed almost constantly, and it is one of the most frequently performed tasks in of the Smog Technician job.

Figure 2. Task Importance Rating Scale

HOW IMPORTANT is performance of this task?

0 NOT IMPORTANT; DOES NOT APPLY TO THE SMOG TECHNICIAN. This task is not important or does not apply to the Smog Technician job.

1 OF MINOR IMPORTANCE. This task is of minor importance relative to other tasks; it would have the lowest priority of all the tasks.

2 FAIRLY IMPORTANT. This task is fairly important relative to other tasks; however, it does not have the priority of importance of most other tasks that are performed.

3 MODERATELY IMPORTANT. This task is moderately important for effective job performance relative to other tasks; it has about average priority among all tasks performed.

4 VERY IMPORTANT. This task is very important for full job performance; it has a higher degree of importance or priority than most other tasks.

5 CRITICALLY IMPORTANT. This task is one of the few critical tasks performed by Smog Technicians.

Figure 3. Task Relevance Rating Scale

Relevance

HOW RELEVANT is this task in relation to determining minimum acceptable competence to work as a Smog Technician? Note: Task relevance for minimum competence is related to task importance, complexity in relation to other tasks, and task outcome in terms of potential harm to the public.

0 OF MINOR RELEVANCE. This is a simple task that is quickly and easily learned.

1 RELEVANT. This is an important step in a complex series of tasks, and Smog Technicians should be able to perform this in order to avoid harm to the public.

2 VERY RELEVANT. This is an essential job function that all Smog Technicians must be able to perform correctly in order to avoid harm to the public.

Figure 4. Knowledge Importance Rating Scale

HOW IMPORTANT is performance of this knowledge?

0 NOT IMPORTANT; DOES NOT APPLY TO THE SMOG TECHNICIAN. This job knowledge does not apply to the Smog Technician job; it is not required for job performance

1 OF MINOR IMPORTANCE. This job knowledge is of minor or incidental importance for the Smog Technician job; it is useful in some minor part of the job.

2 FAIRLY IMPORTANT. This job knowledge is fairly important for job performance in some relatively major part of the Smog Technician job.

3 MODERATELY IMPORTANT. This job knowledge is moderately important for job performance in some relatively major part of the Smog Technician job.

4 VERY IMPORTANT. This rating indicates that this job knowledge is very important for job performance in a significant part of the Smog Technician job.

5 CRITICALLY IMPORTANT. This rating indicates that this job knowledge is critically important for job performance.

Figure 5. Knowledge Relevance Rating Scale

Relevance

HOW RELEVANT is this knowledge in relation to determining minimum acceptable competence to work as a Smog Technician? Note: Knowledge relevance for minimum competence is related to knowledge importance, relation to other knowledge statements, and job outcome in terms of potential harm to the public. The group of SMEs will discuss and arrive at a common understanding of this scale before rating tasks..

0 OF MINOR RELEVANCE. This is a very basic knowledge that is quickly and easily learned.

1 RELEVANT. This is an important element in a cluster of knowledge statements, and Smog Technicians should have this in order to perform the job correctly in avoid harm to the public.

2 VERY RELEVANT. This is an essential job knowledge that all Smog Technicians must have in order to perform the job correctly and avoid harm to the public that all Smog Technicians must be able to perform correctly in order to avoid harm to the public.

The "relevance" rating scales for tasks and knowledge are unique to the current (2009) study. These two scales did not appear in the 2006 study. They were added into the 2009 study to address an issue raised by BAR staff regarding some of tasks and knowledge statements in the 2006 study. Specifically, BAR indicated that some tasks were very quickly and easily learned, and ability to perform such tasks or the related knowledge was not very relevant in determination of minimum competence to work as a Smog Technician. These two scales were constructed specifically to address this concern.

Analysis of Questionnaire Responses

In the 2006 occupational analysis, each of the four exam outlines included weights for each of the relevant content areas. These 2006 weights were based entirely on task ratings – including the Frequency and Importance rating scales. The model used to create the 2006 weights included multiplying ratings from the two scales (this equals "task criticality"), and proportionally accounting for these values across content areas. With this model, content areas with more tasks will carry greater weight. The importance ratings for knowledge were not considered in determination of exam weights in the 2006 study.

For the current study all ratings for both tasks and knowledge were used. Task criticality was calculated by multiplying ratings for the three scales (frequency x importance x relevance). Knowledge criticality was determined by multiplying the two knowledge scales (importance x relevance). Next, task weights were determined separately from knowledge weights. Then, task weights were averaged with knowledge weights to determine recommended exam weights.

Table 2 of this report provides a summary of all task ratings and calculation of the criticality value for tasks. Table 3 presents a summary of all knowledge ratings and calculation of the criticality value for knowledge. The task and knowledge statements in these tables reflect all edits from the job analysis workshops, and represents the final content that was incorporated into the new exam outlines.

Table 4 is split into three parts. These three parts are needed for the calculation of weights, and splitting of content areas into the four exam outlines. Table 4.a. sums the task criticality values by the nine content areas, for 1) tasks performed by all Smog Technicians, 2) tasks performed in Test and Repair settings, and 3) tasks performed in Enhanced Areas – these are referred to as "functional areas" for work performed. Table 4.b. summarizes these same criticality values by functional areas in relation to the four exam outlines. Table 4.c. summaries criticality values as percent weights (for Analysis 1 - 4, content area criticality divided by total criticality).

As with the job task analysis, Tables 5.a, 5.b., and 5.c. show criticality values for knowledge – first by content area and functional area, then by content areas for Analyses 1 through 4, then as percent weight.

Table 6 provides exam weighting recommendations for each of the four exam outlines. This analysis combines the results of Tables 4.c and 5.c (percent weight for task and knowledge), into an average task and knowledge percent weight.

This data analysis protocol accounts for all task ratings (3 rating scales) and all knowledge ratings (2 rating scales). The recommended exam weights are displayed in Table 6. The recommended exam weights are also presented in Table 1 (in the Executive Summary) together with the weights derived in the 2006 analysis. Although there are not great differences between the 2006 and the 2009 analysis, there are some very important differences that are worth noting. These include:

- Content Area I is Consumer Consultation. For the 2009 analysis this content area has been separated into 1) tasks and/or knowledge required of all Smog Technicians, and 2) tasks and/or knowledge required in Test and Repair settings only.

- Large changes in exam weights (3% plus or minus) were observed for the following Exam Plans and Content Areas from the 2006 analysis to the 2009 analysis:

    - Analysis 1. Advanced Smog Technicians in Test and Repair Stations
      - I. Consumer Consultation increased a total of 5% (with 7% of the total to be applied to Test and Repair work settings)
      - IV. Calibration of Analyzer dropped 3%
      - V. Emission Test(s) Procedures dropped 8%
      - VIII. Diagnosis increased 8%
      - IX. Repairs increased 4%

    - Analysis 2. Basic Technicians in Test and Repair Stations
      - I. Consumer Consultation increased a total of 7% (with 8% of the total to be applied to Test and Repair work settings)
      - IV. Calibration of Analyzer dropped 3%
      - V. Emission Test(s) Procedures dropped 7%
      - VII. Functional Tests dropped 5%
      - VIII. Diagnosis increased 7%
      - IX. Repairs increased 5%

    - Analysis 3. Advanced Technicians in Test Only Stations
      - I. Consumer Consultation increased 5%
      - IV. Calibration of Analyzer dropped 3%
      - V. Emission Test(s) Procedures dropped 7%
      - VI. Visual Inspection increased 5%

    - Analysis 4. Basic Technicians in Test Only Stations
      - I. Consumer Consultation increased 5%
      - IV. Calibration of Analyzer dropped 3%
      - V. Emission Test(s) Procedures dropped 3%
      - VI. Visual Inspection increased 4%
      - VII. Functional Tests dropped 3%

III. Exam Outlines

Four exam outlines have been developed, and are displayed in Tables 7 through 10. These include:

- Table 7. Advanced Technicians in Test and Repair Stations (ATR),
- Table 8. Basic Technicians in Test and Repair Stations (BTR),
- Table 9. Advanced Technicians in Test Only Stations (ATO), and
- Table 10. Basic Technicians in Test Only Stations (BTO).

Within each of the exam outlines, tasks and knowledge are first organized by content areas. Next, within content areas, the task and the knowledge statements are presented in order of their total criticality ratings. This means that for the purpose of exam development, items high on these lists are very important for testing, and those low on the lists are less important for testing. Yet, for a content valid exam the test items should be representative of the content for each area listed – then the content of the whole test, as it is to be administered, should be proportionally assembled according to test weights.

The differences in these four exam outlines includes: 1) inclusion of dynamometer tasks/knowledge for Advanced Technicians (ATR and ATO), 2) inclusion of Part b. of the Consumer Consultation tasks/knowledge and content areas VIII and IX for the Test and Repair exam outlines (ATR and BTR), and consequently, from the these content changes, 3) weights are different. Therefore, there is a great deal of redundancy or overlap across these four exam outlines.

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
In this Table, numbering of task statements does not correspond to numbering in the 2006 job analysis report or the 2009 job analysis questionnaire. Instead task statements are ordered by criticality within group, then numbered. Additionally, functional work areas are designated in the right-hand column: "A" tasks apply to all four exam plans, "B" tasks apply to test and repair exam plans, and "C" tasks apply to work in enhanced areas.						
I. Consumer Consultation						
1.	Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.	3.85	4.08	1.15	18.06	A
2.	Inform the consumer about the smog check results by explaining the vehicle inspection report (VIR).	3.00	3.85	1.54	17.79	A
3.	Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.	2.46	4.23	1.31	13.63	A
4.	Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.	2.23	3.92	1.46	12.76	A
5.	Prepare work order for consumer to document smog check inspection to be performed.	2.00	4.00	1.31	10.48	A
6.	Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.	2.23	2.92	1.15	7.49	A
7.	Consult with customer regarding regulations on catalyst replacement.	2.08	3.42	0.92	6.54	A
8.	Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.	2.08	3.31	0.92	6.33	A

Table 2. Task Rating Summary

TASKS		Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
9.	Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.	2.08	2.77	1.00	5.76	A
10.	Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.	1.92	3.42	0.83	5.45	A
11.	Provide consumer with list of stations authorized to diagnose and repair vehicles.	1.62	2.69	1.00	4.36	A
12.	Inform consumer of the option and scope of a pretest smog check inspection to determine if consumer wants an inspection performed.	1.54	2.54	0.85	3.32	A
			Total of Criticality Values		111.97	
13.	Provide consumer with a vehicle repair cost estimate documenting recommended vehicle repairs following diagnostic testing procedures.	2.77	4.46	1.62	20.01	B
14.	Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.	2.62	4.54	1.62	19.27	B
15.	Consult with consumer regarding diagnostic testing if vehicle fails smog check inspection.	3.00	4.08	1.46	17.87	B
16.	Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.	2.54	4.38	1.54	17.13	B
17.	Consult with consumer to determine if vehicle repairs may be covered under warranty prior to performing repairs.	2.23	3.54	1.23	9.71	B
18.	Consult with consumer regarding the retest procedures of a vehicle following repairs made to vehicle.	2.69	3.69	0.92	9.13	B

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
19.	Consult with consumer to determine if vehicle requires testing at a test only station prior to performing smog check inspection.	2.23	3.54	0.92	7.26	B
			Total of Criticality Values		100.32	
II. Vehicle Identification						
20.	Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements.	4.62	4.31	1.77	35.24	A
21.	Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license number) to determine accuracy of information prior to performing smog check inspection.	4.46	4.54	1.62	32.80	A
22.	Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).	4.54	4.31	1.38	27.00	A
23.	Evaluate documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).	3.62	3.85	1.38	19.23	A
			Total of Criticality Values		114.21	
III. Safety Precautions						
24.	Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) prior to performing smog check inspection.	4.46	4.54	1.62	32.80	A
25.	Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.	4.31	4.46	1.23	23.64	A

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
26.	Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.	4.15	4.23	1.23	21.59	A
27.	Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing smog check inspection.	3.08	4.23	1.00	13.03	A
28.	Maintain safety of testing area by keeping area clean.	3.38	3.62	0.69	8.44	A
29.	Consult with consumer for authorization to perform minor repair(s) (e.g., loose hose clamp) on vehicle to ensure safety during smog check inspection.	1.77	3.46	1.15	7.04	A
30.	Perform minor repair(s) (e.g., tighten loose hose clamp) on vehicle if needed during safety inspection.	2.00	3.23	0.69	4.46	A
			Total of Criticality Values		111.02	
	IV. Calibration of Analyzer and Devices					
31.	Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.	3.85	4.38	1.23	20.74	A
32.	Perform visual inspection of analyzer components (i.e., RPM pickup) to ensure accurate functioning during smog check inspection.	3.62	3.62	1.00	13.10	A
33.	Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.	3.46	3.54	0.85	10.41	A
34.	Perform troubleshooting procedures on analyzer sample system to restore function of system.	2.00	3.46	0.92	6.37	A

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
35.	Perform troubleshooting procedures on LPFET analyzer to restore function to system.	2.00	3.15	0.69	4.35	A
36.	Perform troubleshooting procedures on fuel cap test devices to restore function of system.	1.77	3.23	0.69	3.94	A
			Total of Criticality Values		58.91	
37.	Inspect dynamometer to ensure safe operation prior to performing calibration.	3.77	3.92	1.23	18.18	C
38.	Perform troubleshooting procedures on dynamometer to restore function of system.	1.85	3.23	0.69	4.12	C
			Total of Criticality Values		22.33	
V. Emissions Test(s) Procedures						
39.	Remove analyzer devices from vehicle following emissions test as prompted by analyzer.	4.92	4.46	1.00	21.94	A
40.	Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.	4.46	4.23	0.92	17.36	A
41.	Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.	4.92	4.31	0.77	16.33	A
42.	Validate technician authorization to perform emissions test by entering access code into analyzer.	4.77	4.31	0.77	15.83	A
43.	Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.	4.38	3.85	0.92	15.51	A

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
44.	Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.	4.54	4.38	0.77	15.31	A
45.	Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.	3.54	4.23	1.00	14.97	A
46.	Prepare vehicle for LPFET test.	3.69	4.00	1.00	14.76	A
47.	Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.	4.92	4.54	0.62	13.85	A
48.	Perform LPFET test as required by vehicle type.	3.31	3.92	1.00	12.98	A
49.	Secure vehicle during emissions test (e.g., two speed idle) by setting the emergency brake.	3.38	3.85	0.85	11.06	A
50.	Perform pretest smog check inspection on vehicle if authorized by consumer.	2.92	3.15	0.85	7.82	A
			Total of Criticality Values		177.66	
51.	Prepare vehicle for emissions test by securing vehicle onto dynamometer (e.g., blocks, straps).	4.38	4.62	1.38	28.02	C
52.	Perform acceleration simulation mode (ASM) test as prompted by analyzer to evaluate vehicle emissions.	4.54	4.62	1.23	25.78	C
53.	Evaluate vehicle (e.g., front wheel drive, rear wheel drive) to determine placement of vehicle on dynamometer prior to performing emissions test.	4.54	4.54	1.08	22.18	C
54.	Weigh vehicle prior to performing emissions test to set load of dynamometer.	4.46	4.15	0.92	17.11	C

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
55.	Prepare vehicle for emissions test by operating cooling fan to prevent overheating of vehicle during ASM emissions test as prompted by analyzer.	3.31	4.15	0.85	11.63	C
			Total of Criticality Values		104.72	
VI. Visual Inspection						
56.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.	4.62	4.31	1.38	27.48	A
57.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.	4.38	4.15	1.00	18.18	A
58.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.	4.31	4.08	1.00	17.58	A
59.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related components on vehicle.	4.15	3.92	1.08	17.57	A
60.	Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.	4.00	4.00	1.08	17.28	A
61.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.	4.38	3.92	1.00	17.17	A
62.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.	4.38	4.08	0.92	16.44	A

Table 2. Task Rating Summary

TASKS		Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
63.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.	4.08	3.92	1.00	15.99	A
64.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.	4.15	3.85	0.92	14.70	A
65.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.	4.46	3.85	0.85	14.60	A
66.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on vehicle.	3.46	4.00	0.92	12.73	A
67.	Perform visual smoke test.	4.00	3.77	0.85	12.82	A
68.	Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.	3.15	3.85	0.85	10.31	A
			Total of Criticality Values		212.85	
VII. Functional Test(s)						
69.	Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.	3.38	4.15	1.23	17.25	A
70.	Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.	3.38	4.08	1.23	16.96	A
71.	Evaluate vehicle's malfunction indicator light (MIL) by performing functional test.	4.46	4.31	0.77	14.80	A

Table 2. Task Rating Summary

	TASKS	Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
72.	Perform and evaluate LPFET test on vehicle.	3.15	3.92	1.00	12.35	A
73.	Perform fuel cap functional test.	4.62	4.08	0.62	11.69	A
74.	Perform OBDII test as prompted by the analyzer to determine vehicle readiness indicator and code status.	3.92	4.00	0.69	10.82	A
75.	Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.	3.38	2.85	0.38	3.66	A
			Total of Criticality Values		87.59	
VIII. Diagnosis						
76.	Evaluate emissions results (e.g., excessive HC, excessive CO) to identify vehicle system(s) that need diagnostic testing.	3.31	4.54	1.77	26.60	B
77.	Evaluate vehicle to determine if failure was due to physical condition or tampering with.	3.46	4.46	1.54	23.76	B
78.	Perform diagnostic testing on vehicle system(s) that indicate failure during smog check inspection to identify areas of repair.	3.23	4.46	1.62	23.34	B
79.	Evaluate diagnostic readings to determine if a system failure in a vehicle may be causing other systems to fail.	3.15	4.38	1.54	21.25	B
80.	Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.	3.69	4.25	1.33	20.86	B
81.	Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to performing diagnostic testing.	2.92	4.08	1.31	15.61	B
			Total of Criticality Values		131.34	

Table 2. Task Rating Summary

TASKS		Average Frequency Rating	Average Importance Rating	Average Relevance Rating	Criticality: Frequency x Importance x Relevance	
IX. Performing and Verifying Repairs						
82.	Perform after repair smog check inspection to determine if repair of vehicle is successful.	3.25	4.67	1.58	23.98	B
83.	Evaluate diagnostic testing results to determine if components of vehicle system(s) need to be cleaned, repaired, or replaced.	3.08	4.31	1.38	18.32	B
84.	Replace components of vehicle system(s) as indicated by vehicle diagnosis.	3.08	3.83	1.17	13.80	B
85.	Repair components of vehicle system(s) as indicated by vehicle diagnosis.	2.75	3.92	1.25	13.48	B
86.	Clean out components of vehicle system(s) as indicated by vehicle diagnosis.	2.23	3.46	1.08	8.33	B
			Total of Criticality Values		77.93	

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
In this Table, numbering of knowledge statements does not correspond to numbering in the 2006 job analysis report or the 2009 job analysis questionnaire. Instead knowledge statements are ordered by criticality within group, then numbered. Additionally, functional work areas are designated in the right-hand column: "A" knowledge statements apply to all four exam plans;"B" knowledge statements apply to test and repair exam plans; "C" knowledge statements apply to work in enhanced areas.					
I. Consumer Consultation					
1.	Knowledge of reasons for obtaining consumer authorization before performing smog check inspection.	4.54	1.46	6.63	A
2.	Knowledge of information to provide on work orders for smog check inspection.	4.23	1.38	5.86	A
3.	Knowledge of type of information provided in vehicle inspection report (VIR).	4.38	1.31	5.73	A
4.	Knowledge of types of procedure(s) performed during smog check inspection.	4.23	1.31	5.53	A
5.	Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.	3.77	1.38	5.22	A
6.	Knowledge of how to prepare work orders for smog check inspection.	4.15	1.23	5.11	A
7.	Knowledge of laws and regulations requiring consumer authorization for smog check inspection.	4.23	1.15	4.88	A
8.	Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.	4.00	1.08	4.31	A
9.	Knowledge of laws and regulations regarding performing minor repairs on vehicles.	3.77	1.08	4.06	A
10.	Knowledge of laws and regulations for informing consumers about catalytic replacement.	3.92	1.00	3.92	A
11.	Knowledge of laws and regulations regarding educating consumers about repair cost waivers.	3.69	1.00	3.69	A
12.	Knowledge of reasons for performing minor repairs on vehicles.	3.69	1.00	3.69	A
13.	Knowledge of how to determine if vehicle needs minor repairs before performing smog check inspection.	3.67	1.00	3.67	A

Table 3. Knowledge Rating Summary

KNOWLEDGE		Av erage Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
14.	Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).	3.54	1.00	3.54	A
15.	Knowledge of reasons for performing smog check inspection on vehicles.	3.23	1.08	3.48	A
16.	Knowledge of reasons for referring consumers to referee stations (e.g., engine change, SPCNS).	3.54	0.92	3.27	A
17.	Knowledge of laws and regulations requiring vehicles to be tested at a test only station.	3.46	0.92	3.20	A
18.	Knowledge of reasons for providing consumer with vehicle inspection report (VIR).	3.77	0.85	3.19	A
19.	Knowledge of how to determine if a vehicle requires smog check inspection.	3.23	0.92	2.98	A
20.	Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles.	3.23	0.85	2.73	A
21.	Knowledge of how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution).	3.46	0.77	2.66	A
22.	Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection.	3.08	0.85	2.60	A
23.	Knowledge of how to inform consumer about the option and scope of a pretest smog check inspection.	2.69	0.92	2.49	A
24.	Knowledge of procedures used to determine if a consumer wants pretest smog check inspection.	2.85	0.85	2.41	A
25.	Knowledge of how to inform consumers of contact information for stations that diagnose and repair vehicles.	3.08	0.77	2.37	A
26.	Knowledge of how to obtain information from consumers regarding type of smog check inspection needed.	3.15	0.69	2.18	A
		Total of Criticality Values		99.40	

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
27.	Knowledge of laws and regulations regarding performing repairs on vehicles.	4.15	1.46	6.07	B
28.	Knowledge of laws and regulations requiring consumer authorization for performing repairs on vehicles.	4.23	1.38	5.86	B
29.	Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates.	4.08	1.38	5.64	B
30.	Knowledge of laws and regulations about performing diagnostic testing on vehicles.	4.00	1.38	5.54	B
31.	Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles.	4.08	1.31	5.33	B
32.	Knowledge of reasons for performing diagnostic testing on vehicles.	3.85	1.38	5.33	B
33.	Knowledge of reasons for conducting retest procedures on a vehicle following repairs.	3.69	1.15	4.26	B
34.	Knowledge of reasons for performing repairs on vehicles.	3.69	1.15	4.26	B
35.	Knowledge of information provided in vehicle repair cost estimates.	3.69	1.15	4.26	B
36.	Knowledge of how to develop repair cost estimates for a vehicle.	3.92	1.08	4.22	B
37.	Knowledge of how to determine if vehicle repairs are covered under warranty.	3.46	1.15	3.99	B
38.	Knowledge of how to recommend vehicle repairs to consumers.	3.46	1.00	3.46	B
39.	Knowledge of how to obtain information from consumer regarding warranty of vehicle.	3.15	0.92	2.91	B
40.	Knowledge of information to provide consumers about components of a vehicle that may need repair in the future.	3.38	0.85	2.86	B

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
41.	Knowledge of how to determine if smog check inspection of a vehicle needs to be performed at Test Only or Gold Shield station.	3.54	0.77	2.72	B
42.	Knowledge of information to provide consumers about retesting a vehicle following repairs.	3.46	0.77	2.66	B
		Total of Criticality Values		69.37	
II. Vehicle Identification					
43.	Knowledge of how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label.	4.23	1.23	5.21	A
44.	Knowledge of information used to determine when vehicle does not conform to emissions certifications (i.e., Gray Market).	3.77	1.15	4.35	A
45.	Knowledge of how to verify vehicle information prior to performing smog check inspection.	4.15	0.92	3.83	A
46.	Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).	3.62	1.00	3.62	A
47.	Knowledge of how to determine type of vehicle certification (e.g., California, Federal, BAR label).	4.00	0.85	3.38	A
48.	Knowledge of how to verify accuracy of consumer's DMV renewal notice.	3.77	0.77	2.90	A
		Total of Criticality Values		23.29	
III. Safety Precautions					
49.	Knowledge of how to identify unsafe vehicle conditions.	4.46	1.38	6.18	A
50.	Knowledge of how to operate equipment during smog check inspection.	4.31	1.38	5.96	A
51.	Knowledge of how to ensure technician safety while operating equipment during smog check inspection.	4.23	1.38	5.86	A

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
52.	Knowledge of laws and regulations about stations performing repairs on vehicles to ensure safe test conditions.	4.00	1.31	5.23	A
53.	Knowledge of information to provide consumers about unsafe vehicle condition(s).	4.08	1.23	5.02	A
54.	Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.	4.31	1.15	4.97	A
55.	Knowledge of how to inspect the condition of a vehicle.	4.23	1.15	4.88	A
56.	Knowledge of reasons for verifying vehicle safety prior to performing smog check inspection.	4.15	1.08	4.47	A
57.	Knowledge of how to determine when smog check inspection needs to be aborted.	3.85	1.15	4.44	A
58.	Knowledge of equipment used during smog check inspection that could harm consumer, staff, and technician.	3.85	1.00	3.85	A
59.	Knowledge of how to maintain consumer and staff safety while conducting smog check inspection.	3.69	0.92	3.41	A
60.	Knowledge of reasons for performing minor repairs to a vehicle during safety check.	3.54	0.92	3.27	A
61.	Knowledge of references used to inform technician of equipment operation.	3.31	0.69	2.29	A
62.	Knowledge of the requirements for maintaining a clean smog check test area.	3.00	0.50	1.50	A
		Total of Criticality Values		61.33	
IV. Calibration of Analyzer and Devices					
63.	Knowledge of procedures used to calibrate LPFET analyzer.	3.62	1.00	3.62	A
64.	Knowledge of LPFET analyzer upload.	3.54	0.85	2.99	A

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
65.	Knowledge of analyzer components(s) (i.e., RPM pickup, exhaust probe) used during smog check inspection.	3.54	0.77	2.72	A
66.	Knowledge of how to inspect analyzer maintenance components for possible replacement.	3.23	0.77	2.49	A
67.	Knowledge of how to verify function of analyzer component(s) (i.e., RPM, probe pickup).	3.33	0.67	2.22	A
68.	Knowledge of how to verify function of fuel cap test device(s).	3.31	0.62	2.04	A
69.	Knowledge of how to calibrate fuel cap test device(s).	3.38	0.54	1.82	A
70.	Knowledge of how to troubleshoot analyzer system.	2.92	0.62	1.80	A
71.	Knowledge of how to troubleshoot on-line phone connection.	2.92	0.62	1.80	A
72.	Knowledge of references used by technician to troubleshoot analyzer system and components.	2.83	0.58	1.65	A
73.	Knowledge of how to replace analyzer maintenance components.	2.92	0.54	1.57	A
74.	Knowledge of how to troubleshoot fuel cap integrity test device(s).	2.85	0.46	1.31	A
75.	Knowledge of references used by technician to troubleshoot fuel cap test devices.	2.77	0.46	1.28	A
		Total of Criticality Values		27.31	
76.	Knowledge of how to verify operation of dynamometer.	3.54	0.77	2.72	C
77.	Knowledge of how to troubleshoot dynamometer.	3.08	0.62	1.89	C
78.	Knowledge of references used by technician to troubleshoot dynamometer.	2.92	0.62	1.80	C
79.	Knowledge of components of a dynamometer.	3.08	0.38	1.18	C

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
		Total of Criticality Values		7.59	
V. Emissions Test(s) Procedures					
80.	Knowledge of procedures used to perform LPFET test.	3.92	1.08	4.25	A
81.	Knowledge of how to prepare vehicle for performing an emissions test.	4.00	1.00	4.00	A
82.	Knowledge of vehicle information used to prepare for an emissions test.	4.00	1.00	4.00	A
83.	Knowledge of procedures used following the completion of emission(s) test.	3.62	1.00	3.62	A
84.	Knowledge of how to secure vehicle while performing a two-speed idle test.	3.54	1.00	3.54	A
85.	Knowledge of how to enter vehicle information.	4.08	0.85	3.45	A
86.	Knowledge of how to perform two-speed idle (TSI) test.	3.69	0.92	3.41	A
87.	Knowledge of reasons for selecting vehicle gear as prompted by analyzer.	3.54	0.85	2.99	A
88.	Knowledge of reasons for warming vehicle engine prior to performing an emissions test.	3.85	0.69	2.66	A
89.	Knowledge of how to verify weight classification of vehicle.	3.15	0.77	2.43	A
90.	Knowledge of device(s) used to detect engine rpm.	3.69	0.62	2.27	A
91.	Knowledge of how to perform pretest smog check inspection.	3.69	0.62	2.27	A
92.	Knowledge of how to validate technician access to EIS to perform smog check inspection.	3.62	0.62	2.22	A
93.	Knowledge of reasons for verifying weight classification of vehicle.	3.38	0.62	2.08	A
94.	Knowledge of reasons for performing pretest smog check inspection.	3.08	0.62	1.89	A

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
95.	Knowledge of device(s) used to sample vehicle exhaust system.	3.54	0.46	1.63	A
		Total of Criticality Values		46.71	
96.	Knowledge of how to perform acceleration simulation mode (ASM) test.	4.08	1.15	4.70	C
97.	Knowledge of how to determine placement of vehicle on dynamometer.	3.77	1.23	4.64	C
98.	Knowledge of equipment and procedures used to secure vehicle onto dynamometer.	3.77	1.08	4.06	C
99.	Knowledge of reasons for securing vehicle onto dynamometer.	3.77	1.08	4.06	C
100.	Knowledge of how to keep vehicle speed stabilized during acceleration simulation mode (ASM) test.	3.77	1.00	3.77	C
101.	Knowledge of how to prevent vehicle from overheating during an acceleration simulation mode (ASM) test.	3.77	0.92	3.48	C
102.	Knowledge of reasons for assessing vehicle prior to placing on dynamometer.	3.62	0.92	3.34	C
103.	Knowledge of how to weigh vehicle on dynamometer.	3.23	0.69	2.24	C
104.	Knowledge of reasons for weighing vehicle on dynamometer.	3.15	0.54	1.70	C
		Total of Criticality Values		31.99	
VI. Visual Inspection					
105.	Knowledge of references (e.g., CARB, Appendix K) used to identify approved replacement emission components.	3.85	1.23	4.73	A
106.	Knowledge of references used to identify required emission controlled components of a vehicle.	3.77	1.15	4.35	A
107.	Knowledge of how to identify liquid fuel leaks.	3.77	1.08	4.06	A

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
108.	Knowledge of how to verify vehicle emission components.	3.77	1.08	4.06	A
109.	Knowledge of how to evaluate fuel induction system.	3.62	1.08	3.89	A
110.	Knowledge of reasons for identifying liquid fuel leaks.	3.85	1.00	3.85	A
111.	Knowledge of how to verify condition of fuel injection system.	3.54	1.08	3.81	A
112.	Knowledge of fuel induction system components.	3.54	1.08	3.81	A
113.	Knowledge of procedures used to perform visible smoke test.	3.77	1.00	3.77	A
114.	Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.	3.46	1.08	3.73	A
115.	Knowledge of references used to identify other vehicle emissions related components that are permitted in vehicle.	3.46	1.08	3.73	A
116.	Knowledge of sensors, switches, and computers in vehicle.	3.46	1.08	3.73	A
117.	Knowledge of how to verify condition of carburetor in fuel induction system.	3.38	1.08	3.64	A
118.	Knowledge of ignition spark control system(s).	3.31	1.08	3.56	A
119.	Knowledge of how to identify installation of other vehicle emission related components.	3.54	1.00	3.54	A
120.	Knowledge of air injection (AIS) system components.	3.50	1.00	3.50	A
121.	Knowledge of positive crankcase ventilation (PCV) system components.	3.46	1.00	3.46	A
122.	Knowledge of references used to identify sensors, switches, and computers of vehicle.	3.38	1.00	3.38	A

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
123.	Knowledge of references used to identify components of the fuel induction system.	3.38	1.00	3.38	A
124.	Knowledge of references used to identify components of the ignition spark control system(s).	3.38	1.00	3.38	A
125.	Knowledge of how to evaluate ignition spark control system(s).	3.38	1.00	3.38	A
126.	Knowledge of how to verify condition of TCS switches in ignition spark control system(s).	3.31	1.00	3.31	A
127.	Knowledge of how to verify condition of sensors in ignition spark control system(s).	3.31	1.00	3.31	A
128.	Knowledge of how to evaluate air injection (AIS) system.	3.50	0.92	3.23	A
129.	Knowledge of how to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.	3.46	0.92	3.20	A
130.	Knowledge of how to evaluate catalytic converter system.	3.46	0.92	3.20	A
131.	Knowledge of fuel evaporative (EVAP) system components.	3.46	0.92	3.20	A
132.	Knowledge of how to verify condition of hoses in fuel induction system.	3.46	0.92	3.20	A
133.	Knowledge of how to verify condition of sensors.	3.38	0.92	3.12	A
134.	Knowledge of how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.	3.38	0.92	3.12	A
135.	Knowledge of how to evaluate exhaust gas recirculation (EGR) system.	3.67	0.85	3.10	A
136.	Knowledge of how to evaluate fuel evaporative (EVAP) system.	3.33	0.92	3.08	A
137.	Knowledge of how to verify condition of wiring.	3.31	0.92	3.05	A

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
138.	Knowledge of how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.	3.31	0.92	3.05	A
139.	Knowledge of how to verify condition of wiring in fuel induction system.	3.31	0.92	3.05	A
140.	Knowledge of exhaust gas recirculation (EGR) system components.	3.54	0.85	2.99	A
141.	Knowledge of how to verify condition of spark delay valves in ignition spark control system(s).	3.23	0.92	2.98	A
142.	Knowledge of how to verify condition of speed switches in exhaust gas recirculation (EGR) system.	3.23	0.92	2.98	A
143.	Knowledge of how to verify condition of electrical components in air injection (AIS) system.	3.23	0.92	2.98	A
144.	Knowledge of how to evaluate positive crankcase ventilation (PCV) system.	3.46	0.85	2.93	A
145.	Knowledge of how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system.	3.38	0.85	2.86	A
146.	Knowledge of how to verify condition of vapor storage canister in fuel evaporative (EVAP) system.	3.31	0.85	2.80	A
147.	Knowledge of how to evaluate sensors, switches, and computers.	3.31	0.85	2.80	A
148.	Knowledge of how to verify condition of air pump in air injection (AIS) system.	3.31	0.85	2.80	A
149.	Knowledge of how to verify condition of valve(s) in positive crankcase ventilation (PCV) system.	3.31	0.85	2.80	A
150.	Knowledge of how to evaluate thermostatic air cleaner (TAC) system.	3.31	0.85	2.80	A
151.	Knowledge of references used to identify components of the exhaust gas recirculation (EGR) system.	3.62	0.77	2.78	A

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
152.	Knowledge of how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system.	3.25	0.85	2.75	A
153.	Knowledge of how to verify condition of valve(s) in air injection (AIS) system.	3.23	0.85	2.73	A
154.	Knowledge of how to verify condition of vacuum signal lines in air injection (AIS) system.	3.23	0.85	2.73	A
155.	Knowledge of how to verify type of fuel tank cap in fuel evaporative (EVAP) system.	3.23	0.85	2.73	A
156.	Knowledge of how to verify condition of solenoids in fuel evaporative (EVAP) system.	3.23	0.85	2.73	A
157.	Knowledge of external damage to catalytic converter system.	3.15	0.85	2.67	A
158.	Knowledge of how to verify condition of thermal vacuum switches in ignition spark control system(s).	3.15	0.85	2.67	A
159.	Knowledge of how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system.	3.15	0.85	2.67	A
160.	Knowledge of how to verify condition of hoses in fuel evaporative (EVAP) system.	3.31	0.77	2.54	A
161.	Knowledge of references used to identify components of the fuel evaporative (EVAP) system.	3.31	0.77	2.54	A
162.	Knowledge of references used to identify components of the air injection (AIS) system.	3.31	0.75	2.48	A
163.	Knowledge of references used to identify components of the thermostatic air cleaner (TAC) system.	3.17	0.77	2.44	A
164.	Knowledge of how to verify condition of heat delivery pipes in thermostatic air cleaner (TAC) system.	3.17	0.77	2.44	A
165.	Knowledge of thermostatic air cleaner (TAC) system components.	3.17	0.77	2.44	A

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
166.	Knowledge of how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system.	3.17	0.77	2.44	A
167.	Knowledge of how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system.	3.08	0.77	2.37	A
168.	Knowledge of how to verify condition of heat stoves in thermostatic air cleaner (TAC) system.	3.08	0.77	2.37	A
169.	Knowledge of how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.	3.38	0.69	2.34	A
170.	Knowledge of how to verify condition of required hoses in positive crankcase ventilation (PCV) system.	3.23	0.69	2.24	A
171.	Knowledge of how to verify routing of distribution hoses in air injection (AIS) system.	3.23	0.69	2.24	A
172.	Knowledge of references used to identify components of the positive crankcase ventilation (PCV) system.	3.15	0.69	2.18	A
		Total of Criticality Values		210.20	
VII. Functional Test(s)					
173.	Knowledge of how to verify function of exhaust gas recirculation (EGR) system.	3.85	1.15	4.44	A
174.	Knowledge of how to perform LPFET test.	3.85	1.15	4.44	A
175.	Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.	3.85	1.08	4.14	A
176.	Knowledge of vehicles that require LPFET test.	3.54	1.08	3.81	A
177.	Knowledge of the purpose for performing LPFET test.	3.46	1.08	3.73	A
178.	Knowledge of how to verify vehicle ignition timing.	3.69	1.00	3.69	A
179.	Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.	3.62	0.92	3.34	A

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
180.	Knowledge of vehicles that are exempt from ignition timing functional test.	3.54	0.92	3.27	A
181.	Knowledge of how to perform fuel cap functional test.	3.54	0.85	2.99	A
182.	Knowledge of procedures for performing OBD II functional test.	3.62	0.77	2.78	A
183.	Knowledge of reasons for performing ignition timing functional test.	3.15	0.85	2.67	A
184.	Knowledge of how to verify function of malfunction indicator light (MIL).	3.85	0.69	2.66	A
185.	Knowledge of reasons for performing OBD II functional test.	3.38	0.77	2.60	A
186.	Knowledge of reasons for performing exhaust gas recirculation (EGR) functional test.	3.38	0.77	2.60	A
187.	Knowledge of reasons for performing fuel cap functional test.	3.23	0.77	2.49	A
188.	Knowledge of vehicles that require fuel cap functional test.	3.15	0.77	2.43	A
189.	Knowledge of reasons for performing fillpipe restrictor functional test.	2.69	0.62	1.66	A
190.	Knowledge of how to verify function of fillpipe restrictors.	2.54	0.54	1.37	A
		Total of Criticality Values		55.11	
VIII. Diagnosis					
191.	Knowledge of how to interpret diagnostic readings.	4.46	1.50	6.69	B
192.	Knowledge of how to perform onboard diagnostic testing.	4.15	1.54	6.39	B
193.	Knowledge of how to interpret vehicle inspection report (VIR) results.	4.31	1.46	6.30	B

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
194.	Knowledge of interpreting diagnostic testing results indicating vehicle system failures impacting other systems.	4.31	1.46	6.30	B
195.	Knowledge of how to diagnose catalytic converter system.	4.23	1.46	6.18	B
196.	Knowledge of equipment used to perform diagnostic testing procedures.	4.31	1.38	5.96	B
197.	Knowledge of how to verify the condition of engine mechanical systems.	4.00	1.46	5.85	B
198.	Knowledge of relationships between vehicle systems.	4.15	1.38	5.75	B
199.	Knowledge of components of vehicle systems that may have been tampered with.	4.15	1.38	5.75	B
200.	Knowledge of components of vehicle systems that may have been damaged.	4.00	1.38	5.54	B
201.	Knowledge of mechanical components that need repair or replacement.	4.00	1.38	5.54	B
202.	Knowledge of hydrocarbon (HC) emission levels.	4.23	1.31	5.53	B
203.	Knowledge of carbon monoxide (CO) emission levels.	4.23	1.31	5.53	B
204.	Knowledge of oxides of nitrogen (NOx) emission levels.	4.23	1.31	5.53	B
205.	Knowledge of how to diagnose fuel induction system.	3.92	1.38	5.43	B
206.	Knowledge of how to diagnose exhaust gas recirculation (EGR) system.	4.08	1.31	5.33	B
207.	Knowledge of references used when performing diagnostic testing on a vehicle.	4.00	1.33	5.33	B
208.	Knowledge of how to diagnose sensors, switches, and computers.	4.00	1.31	5.23	B
209.	Knowledge of oxygen (O2) emission levels.	4.08	1.23	5.02	B

Table 3. Knowledge Rating Summary

	KNOWLEDGE	Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
210.	Knowledge of carbon dioxide (CO2) emission levels.	4.08	1.23	5.02	B
211.	Knowledge of how to diagnose evaporative (EVAP) system.	4.00	1.23	4.92	B
212.	Knowledge of information indicated on vehicle inspection report (VIR).	4.00	1.23	4.92	B
213.	Knowledge of how to verify condition of vehicle catalytic converter system.	3.92	1.23	4.83	B
214.	Knowledge of how to verify condition of vehicle fuel induction system.	3.69	1.31	4.83	B
215.	Knowledge of emissions that are considered hazardous.	3.77	1.23	4.64	B
216.	Knowledge of how to diagnose ignition spark control system(s).	3.77	1.23	4.64	B
217.	Knowledge of references used to verify vehicle systems condition.	3.69	1.23	4.54	B
218.	Knowledge of how to verify condition of vehicle exhaust gas recirculation (EGR) system.	3.85	1.15	4.44	B
219.	Knowledge of how to diagnose other related emissions components.	3.85	1.15	4.44	B
220.	Knowledge of references used when evaluating vehicle inspection report (VIR).	3.54	1.23	4.36	B
221.	Knowledge of how to diagnose positive crankcase ventilation (PCV) system.	3.77	1.15	4.35	B
222.	Knowledge of how to verify condition of vehicle sensors, switches, and computers.	3.77	1.15	4.35	B
223.	Knowledge of how to verify condition of vehicle evaporative (EVAP) system.	3.77	1.15	4.35	B
224.	Knowledge of how to verify condition of other related emissions components.	3.77	1.15	4.35	B
225.	Knowledge of how to diagnose air injection (AIS) system.	3.69	1.15	4.26	B
226.	Knowledge of how to diagnose thermostatic air cleaner (TAC) system.	3.69	1.15	4.26	B

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
227.	Knowledge of how to verify condition of vehicle ignition spark control system(s).	3.69	1.15	4.26	B
228.	Knowledge of how to verify condition of vehicle air injection (AIS) system.	3.62	1.15	4.17	B
229.	Knowledge of reasons for performing a baseline test prior to diagnosing a vehicle.	3.62	1.15	4.17	B
230.	Knowledge of how to verify condition of vehicle thermostatic air cleaner (TAC) system.	3.54	1.15	4.08	B
231.	Knowledge of how to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems.	4.00	1.00	4.00	B
232.	Knowledge of how to verify condition of vehicle positive crankcase ventilation (PCV) system.	3.69	1.08	3.98	B
233.	Knowledge of how to perform a baseline test prior to diagnosing a vehicle.	3.85	1.00	3.85	B
		Total of Criticality Values		215.19	
IX. Performing and Verifying Repairs					
234.	Knowledge of catalytic converter system components that need replacement.	4.23	1.46	6.18	B
235.	Knowledge of how to verify vehicle systems repairs.	4.08	1.46	5.96	B
236.	Knowledge of sensor, switch, and computer components that need replacement.	4.00	1.46	5.85	B
237.	Knowledge of vehicle system components that need repair.	4.15	1.38	5.75	B
238.	Knowledge of evaporative (EVAP) system components that need repair.	4.08	1.38	5.64	B
239.	Knowledge of components of exhaust gas recirculation (EGR) system that need repair.	4.08	1.38	5.64	B
240.	Knowledge of sensor, switch, and computer components that need repair.	4.08	1.38	5.64	B

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
241.	Knowledge of ignition spark control system components that need replacement.	3.85	1.46	5.62	B
242.	Knowledge of ignition spark control system components that need repair.	4.00	1.38	5.54	B
243.	Knowledge of exhaust gas recirculation (EGR) system components that need replacement.	3.92	1.38	5.43	B
244.	Knowledge of how to determine type of vehicle repair to be performed.	4.15	1.31	5.43	B
245.	Knowledge of how to repair vehicle system(s).	4.08	1.31	5.33	B
246.	Knowledge of air injection (AIS) system components that need repair.	3.85	1.38	5.33	B
247.	Knowledge of catalytic converter system components that need repair.	4.08	1.31	5.33	B
248.	Knowledge of how to determine if components of vehicle need to be cleaned, repaired, or replaced.	4.00	1.31	5.23	B
249.	Knowledge of other related vehicle components that need repair.	4.00	1.31	5.23	B
250.	Knowledge of vehicle system components that need replacement.	4.00	1.31	5.23	B
251.	Knowledge of fuel induction system components that need repair.	4.00	1.31	5.23	B
252.	Knowledge of fuel induction system components that need replacement.	3.85	1.31	5.03	B
253.	Knowledge of thermostatic air cleaner (TAC) system components that need repair.	3.85	1.31	5.03	B
254.	Knowledge of air injection (AIS) system components need replacement.	3.77	1.31	4.93	B
255.	Knowledge of references used to assist technician in performing repairs to a vehicle.	3.92	1.23	4.83	B
256.	Knowledge of evaporative (EVAP) system components that need replacement.	3.85	1.23	4.73	B
257.	Knowledge of how to differentiate between minor and major vehicle repairs.	3.85	1.23	4.73	B

Table 3. Knowledge Rating Summary

KNOWLEDGE		Average Importance Rating	Average Relevance Rating	Criticality: Importance x Relevance	
258.	Knowledge of how to perform an "after repair" smog check inspection.	4.08	1.15	4.70	B
259.	Knowledge of positive crankcase ventilation (PCV) system components that need repair.	3.77	1.23	4.64	B
260.	Knowledge of procedures and equipment used to clean out components of vehicle system(s).	3.77	1.23	4.64	B
261.	Knowledge of other related vehicle components that need replacement.	3.77	1.23	4.64	B
262.	Knowledge of positive crankcase ventilation (PCV) system components that need replacement.	3.92	1.15	4.53	B
263.	Knowledge of how to replace components of vehicle systems.	3.85	1.15	4.44	B
264.	Knowledge of equipment used to repair vehicle system(s).	3.85	1.15	4.44	B
265.	Knowledge of thermostatic air cleaner (TAC) system components that need replacement.	3.54	1.23	4.36	B
266.	Knowledge of reasons for performing an "after repair" smog check inspection.	3.85	1.08	4.14	B
267.	Knowledge of equipment used to replace vehicle system(s).	3.38	1.00	3.38	B
			Total of Criticality Values	172.78	

Table 4.a Task Analysis: Total Criticality Values by Functional Areas

TASK CONTENT AREAS	A	B	C
I.a Consumer Consultation - All	111.97		
I.b Consumer Consultation - Diagnosis + Repair Related		100.32	
II. Vehicle Identification	114.21		
III. Safety Precautions	111.02		
IV. Calibration of Analyzer and Devices	58.91		22.33
V. Emissions Test(s) Procedures	177.66		104.72
VI. Visual Inspection	212.85		
VII. Functional Test(s)	87.59		
VIII. Diagnosis		131.34	
IX. Performing and Verifying Repairs		77.93	

A = Tasks performed by all Smog Technicians

B = Tasks performed by Test & Repair Smog Technicians Only

C = Tasks performed in Enhanced Areas Only

Table 4.b Task Analysis: Total Criticality Values by Exam Plans

(Data for A, B and C taken from Table 4.a)

TASK CONTENT AREAS	Analysis 1 Advanced Technicians in Test & Repair Stations (ATR)	Analysis 2 Basic Technicians in Test & Repair Stations (BTR)	Analysis 3 Advanced Technicians in Test Only Stations (ATO)	Analysis 4 Basic Technicians in Test Only Stations (BTO)
	A+B+C	A+B	A+C	A
I.a Consumer Consultation - All	111.97	111.97	111.97	111.97
I.b Consumer Consultation - Diagnosis + Repair Related	100.32	100.32		
II. Vehicle Identification	114.21	114.21	114.21	114.21
III. Safety Precautions	111.02	111.02	111.02	111.02
IV. Calibration of Analyzer and Devices	81.24	58.91	81.24	58.91
V. Emissions Test(s) Procedures	282.38	177.66	282.38	177.66
VI. Visual Inspection	212.85	212.85	212.85	212.85
VII. Functional Test(s)	87.59	87.59	87.59	87.59
VIII. Diagnosis	131.34	131.34		
IX. Performing and Verifying Repairs	77.93	77.93		
	1310.85	1183.80	1001.26	874.21

Table 4.c Task Analysis: Percent Weight for Task Content Areas

(Table 4.b values divided by total for Analyses 1 - 4)

TASK CONTENT AREAS	Analysis 1 Advanced Technicians in Test & Repair Stations (ATR)	Analysis 2 Basic Technicians in Test & Repair Stations (BTR)	Analysis 3 Advanced Technicians in Test Only Stations (ATO)	Analysis 4 Basic Technicians in Test Only Stations (BTO)
I.a Consumer Consultation - All	9%	9%	11%	13%
I.b Consumer Consultation - Diagnosis + Repair Related	8%	8%		
II. Vehicle Identification	9%	10%	11%	13%
III. Safety Precautions	8%	9%	11%	13%
IV. Calibration of Analyzer and Devices	6%	5%	8%	7%
V. Emissions Test(s) Procedures	22%	15%	28%	20%
VI. Visual Inspection	16%	18%	21%	24%
VII. Functional Test(s)	7%	7%	9%	10%
VIII. Diagnosis	10%	11%		
IX. Performing and Verifying Repairs	6%	7%		

Table 5.a Knowledge Analysis: Total Criticality Values by Functional Areas

KNOWLEDGE CONTENT AREAS	A	B	C
I.a Consumer Consultation - All	99.40		
I.b Consumer Consultation - Diagnosis + Repair Related		69.37	
II. Vehicle Identification	23.29		
III. Safety Precautions	61.33		
IV. Calibration of Analyzer and Devices	27.31		7.59
V. Emissions Test(s) Procedures	46.71		31.99
VI. Visual Inspection	210.20		
VII. Functional Test(s)	55.11		
VIII. Diagnosis		215.19	
IX. Performing and Verifying Repairs		172.78	

A = Knowledge needed by all Smog Technicians

B = Knowledge needed by Test & Repair Smog Technicians Only

C = Knowledge needed in Enhanced Areas Only

Table 5.b Knowledge Analysis: Total Criticality Values by Exam Outlines

(Data for A, B and C functional areas taken from Table 5.a)

KNOWLEDGE CONTENT AREAS	Analysis 1 Advanced Technicians in Test & Repair Stations (ATR)	Analysis 2 Basic Technicians in Test & Repair Stations (BTR)	Analysis 3 Advanced Technicians in Test Only Stations (ATO)	Analysis 4 Basic Technicians in Test Only Stations (BTO)
	A+B+C	A+B	A+C	A
I.a Consumer Consultation - All	99.40	99.40	99.40	99.40
I.b Consumer Consultation - Diagnosis + Repair Related	69.37	69.37		
II. Vehicle Identification	23.29	23.29	23.29	23.29
III. Safety Precautions	61.33	61.33	61.33	61.33
IV. Calibration of Analyzer and Devices	34.90	27.31	34.90	27.31
V. Emissions Test(s) Procedures	78.70	46.71	78.70	46.71
VI. Visual Inspection	210.20	210.20	210.20	210.20
VII. Functional Test(s)	55.11	55.11	55.11	55.11
VIII. Diagnosis	215.19	215.19		
IX. Performing and Verifying Repairs	172.78	172.78		
	1020.27	980.69	562.93	523.35

Table 5.c Knowledge Analysis: Percent Weight for Knowledge Content Areas

(Table 5.b values divided by total for Analyses 1 - 4)

KNOWLEDGE CONTENT AREAS	Analysis 1 Advanced Technicians in Test & Repair Stations (ATR)	Analysis 2 Basic Technicians in Test & Repair Stations (BTR)	Analysis 3 Advanced Technicians in Test Only Stations (ATO)	Analysis 4 Basic Technicians in Test Only Stations (BTO)
I.a Consumer Consultation - All	10%	10%	18%	19%
I.b Consumer Consultation - Diagnosis + Repair Related	7%	7%		
II. Vehicle Identification	2%	2%	4%	4%
III. Safety Precautions	6%	6%	11%	12%
IV. Calibration of Analyzer and Devices	3%	3%	6%	5%
V. Emissions Test(s) Procedures	8%	5%	14%	9%
VI. Visual Inspection	21%	21%	37%	40%
VII. Functional Test(s)	5%	6%	10%	11%
VIII. Diagnosis	21%	22%		
IX. Performing and Verifying Repairs	17%	18%		

Table 6. Recommended Exam Weights by Exam Outlines

(Average of Task and Knowledge Percent Weights from Tables 4.c and 5.c.)

TASK AND KNOWLEDGE CONTENT AREAS	Analysis 1 Advanced Technicians in Test & Repair Stations (ATR)	Analysis 2 Basic Technicians in Test & Repair Stations (BTR)	Analysis 3 Advanced Technicians in Test Only Stations (ATO)	Analysis 4 Basic Technicians in Test Only Stations (BTO)
I.a Consumer Consultation - All	9%	10%	15%	16%
I.b Consumer Consultation - Diagnosis + Repair Related	7%	8%		
II. Vehicle Identification	6%	6%	8%	9%
III. Safety Precautions	7%	8%	11%	12%
IV. Calibration of Analyzer and Devices	5%	4%	7%	6%
V. Emissions Test(s) Procedures	15%	10%	21%	15%
VI. Visual Inspection	18%	20%	29%	32%
VII. Functional Test(s)	6%	6%	9%	10%
VIII. Diagnosis	16%	16%		
IX. Performing and Verifying Repairs	11%	12%		

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

I.a Consumer Consultation (9%)

This area assess the candidate's ability to consult with the consumer about authorization to perform smog check inspections according to state law and regulations.

TASKS

1. Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.
2. Inform the consumer about the smog check results by explaining the vehicle inspection report (VIR).
3. Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.
4. Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.
5. Prepare work order for consumer to document smog check inspection to be performed.
6. Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.
7. Consult with customer regarding regulations on catalyst replacement.
8. Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.
9. Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.
10. Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.
11. Provide consumer with list of stations authorized to diagnose and repair vehicles.

ASSOCIATED KNOWLEDGE

1. Knowledge of reasons for obtaining consumer authorization before performing smog check inspection.
2. Knowledge of information to provide on work orders for smog check inspection.
3. Knowledge of type of information provided in vehicle inspection report (VIR).
4. Knowledge of types of procedure(s) performed during smog check inspection.
5. Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
6. Knowledge of how to prepare work orders for smog check inspection.
7. Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
8. Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.
9. Knowledge of laws and regulations regarding performing minor repairs on vehicles.
10. Knowledge of laws and regulations for informing consumers about catalytic replacement.
11. Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
12. Knowledge of reasons for performing minor repairs on vehicles.
13. Knowledge of how to determine if vehicle needs minor repairs before performing smog check inspection.
14. Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).
15. Knowledge of reasons for performing smog

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

12. Inform consumer of the option and scope of a pretest smog check inspection to determine if consumer wants an inspection performed.

check inspection on vehicles.

16. Knowledge of reasons for referring consumers to referee stations (e.g., engine change, SPCNS).
17. Knowledge of laws and regulations requiring vehicles to be tested at a test only station.
18. Knowledge of reasons for providing consumer with vehicle inspection report (VIR).
19. Knowledge of how to determine if a vehicle requires smog check inspection.
20. Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles.
21. Knowledge of how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution).
22. Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection.
23. Knowledge of how to inform consumer about the option and scope of a pretest smog check inspection.
24. Knowledge of procedures used to determine if a consumer wants pretest smog check inspection.
25. Knowledge of how to inform consumers of contact information for stations that diagnose and repair vehicles.
26. Knowledge of how to obtain information from consumers regarding type of smog check inspection needed.

I.b Consumer Consultation – Diagnosis + Repair Related (7%)

This area assess the candidate's ability to consult with the consumer about reasons for performing diagnostic testing and the authorization to perform smog system repairs.

TASKS

13. Provide consumer with a vehicle repair cost estimate documenting recommended vehicle repairs following diagnostic testing procedures.

ASSOCIATED KNOWLEDGE

27. Knowledge of laws and regulations regarding performing repairs on vehicles.
28. Knowledge of laws and regulations requiring consumer authorization for performing

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

14. Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.
15. Consult with consumer regarding diagnostic testing if vehicle fails smog check inspection.
16. Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.
17. Consult with consumer to determine if vehicle repairs may be covered under warranty prior to performing repairs.
18. Consult with consumer regarding the retest procedures of a vehicle following repairs made to vehicle.
19. Consult with consumer to determine if vehicle requires testing at a test only station prior to performing smog check inspection.

repairs on vehicles.

29. Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates.
30. Knowledge of laws and regulations about performing diagnostic testing on vehicles.
31. Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles.
32. Knowledge of reasons for performing diagnostic testing on vehicles.
33. Knowledge of reasons for conducting retest procedures on a vehicle following repairs.
34. Knowledge of reasons for performing repairs on vehicles.
35. Knowledge of information provided in vehicle repair cost estimates.
36. Knowledge of how to develop repair cost estimates for a vehicle.
37. Knowledge of how to determine if vehicle repairs are covered under warranty.
38. Knowledge of how to recommend vehicle repairs to consumers.
39. Knowledge of how to obtain information from consumer regarding warranty of vehicle.
40. Knowledge of information to provide consumers about components of a vehicle that may need repair in the future.
41. Knowledge of how to determine if smog check inspection of a vehicle needs to be performed at Test Only or Gold Shield station.
42. Knowledge of information to provide consumers about retesting a vehicle following repairs.

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

II. Vehicle Identification (6%)

This area assess the candidate's ability to identify the vehicle to be tested.

TASKS

20. Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements.
21. Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license number) to determine accuracy of information prior to performing smog check inspection.
22. Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).
23. Evaluate documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).

ASSOCIATED KNOWLEDGE

43. Knowledge of how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label.
44. Knowledge of information used to determine when vehicle does not conform to emissions certifications (i.e., Gray Market).
45. Knowledge of how to verify vehicle information prior to performing smog check inspection.
46. Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).
47. Knowledge of how to determine type of vehicle certification (e.g., California, Federal, BAR label).
48. Knowledge of how to verify accuracy of consumer's DMV renewal notice

III. Safety Precautions (7%)

This areas assess the candidate's ability to identify and determine whether the vehicle presented for testing has any conditions that would render emissions testing problematic and/or unsafe.

TASKS

24. Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) prior to performing smog check inspection.
25. Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.
26. Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.
27. Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing

ASSOCIATED KNOWLEDGE

49. Knowledge of how to identify unsafe vehicle conditions.
50. Knowledge of how to operate equipment during smog check inspection.
51. Knowledge of how to ensure technician safety while operating equipment during smog check inspection.
52. Knowledge of laws and regulations about stations performing repairs on vehicles to ensure safe test conditions.
53. Knowledge of information to provide consumers about unsafe vehicle condition(s).
54. Knowledge of procedures used during smog check inspection if vehicle safety standards

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

smog check inspection.
28. Maintain safety of testing area by keeping area clean.
29. Consult with consumer for authorization to perform minor repair(s) (e.g., loose hose clamp) on vehicle to ensure safety during smog check inspection.
30. Perform minor repair(s) (e.g., tighten loose hose clamp) on vehicle if needed during safety inspection.

are not acceptable.
55. Knowledge of how to inspect the condition of a vehicle.
56. Knowledge of reasons for verifying vehicle safety prior to performing smog check inspection.
57. Knowledge of how to determine when smog check inspection needs to be aborted.
58. Knowledge of equipment used during smog check inspection that could harm consumer, staff, and technician.
59. Knowledge of how to maintain consumer and staff safety while conducting smog check inspection.
60. Knowledge of reasons for performing minor repairs to a vehicle during safety check.
61. Knowledge of references used to inform technician of equipment operation.
62. Knowledge of the requirements for maintaining a clean smog check test area.

IV. Calibration of Analyzer and Devices (5%)

This areas assess the candidate's ability to interpret and respond to analyzer prompts, maintain or troubleshoot analyzer system malfunctions and perform required analyzer service procedures (including dynamometer).

TASKS

31. Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.
32. Perform visual inspection of analyzer components (i.e., RPM pickup) to ensure accurate functioning during smog check inspection.
33. Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.
34. Perform troubleshooting procedures on analyzer sample system to restore function of system.
35. Perform troubleshooting procedures on LPFET analyzer to restore function to system.
36. Perform troubleshooting procedures on fuel

ASSOCIATED KNOWLEDGE

63. Knowledge of procedures used to calibrate LPFET analyzer.
64. Knowledge of LPFET analyzer upload.
65. Knowledge of analyzer components(s) (i.e., RPM pickup, exhaust probe) used during smog check inspection.
66. Knowledge of how to inspect analyzer maintenance components for possible replacement.
67. Knowledge of how to verify function of analyzer component(s) (i.e., RPM, probe pickup).
68. Knowledge of how to verify function of fuel cap test device(s).
69. Knowledge of how to calibrate fuel cap test device(s).
70. Knowledge of how to troubleshoot analyzer

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

cap test devices to restore function of system.
37. Inspect dynamometer to ensure safe operation prior to performing calibration.
38. Perform troubleshooting procedures on dynamometer to restore function of system.

system.
71. Knowledge of how to troubleshoot on-line phone connection.
72. Knowledge of references used by technician to troubleshoot analyzer system and components.
73. Knowledge of how to replace analyzer maintenance components.
74. Knowledge of how to troubleshoot fuel cap integrity test device(s).
75. Knowledge of references used by technician to troubleshoot fuel cap test devices.
76. Knowledge of how to verify operation of dynamometer.
77. Knowledge of how to troubleshoot dynamometer.
78. Knowledge of references used by technician to troubleshoot dynamometer.
79. Knowledge of components of a dynamometer.

V. Emissions Test(s) Procedures (15%)

This areas assess the candidate's ability to use correct procedures for testing the functional operations of emissions-related components (including dynamometer).

TASKS

39. Remove analyzer devices from vehicle following emissions test as prompted by analyzer.
40. Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.
41. Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.
42. Validate technician authorization to perform emissions test by entering access code into analyzer.
43. Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.
44. Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.

ASSOCIATED KNOWLEDGE

80. Knowledge of procedures used to perform LPFET test.
81. Knowledge of how to prepare vehicle for performing an emissions test.
82. Knowledge of vehicle information used to prepare for an emissions test.
83. Knowledge of procedures used following the completion of emission(s) test.
84. Knowledge of how to secure vehicle while performing a two-speed idle test.
85. Knowledge of how to enter vehicle information.
86. Knowledge of how to perform two-speed idle (TSI) test.
87. Knowledge of reasons for selecting vehicle gear as prompted by analyzer.
88. Knowledge of reasons for warming vehicle engine prior to performing an emissions test.

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

45. Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.
46. Prepare vehicle for LPFET test.
47. Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.
48. Perform LPFET test as required by vehicle type.
49. Secure vehicle during emissions test (e.g., two speed idle) by setting the emergency brake.
50. Perform pretest smog check inspection on vehicle if authorized by consumer.
51. Prepare vehicle for emissions test by securing vehicle onto dynamometer (e.g., blocks, straps).
52. Perform acceleration simulation mode (ASM) test as prompted by analyzer to evaluate vehicle emissions.
53. Evaluate vehicle (e.g., front wheel drive, rear wheel drive) to determine placement of vehicle on dynamometer prior to performing emissions test.
54. Weigh vehicle prior to performing emissions test to set load of dynamometer.
55. Prepare vehicle for emissions test by operating cooling fan to prevent overheating of vehicle during ASM emissions test as prompted by analyzer.

89. Knowledge of how to verify weight classification of vehicle.
90. Knowledge of device(s) used to detect engine rpm.
91. Knowledge of how to perform pretest smog check inspection.
92. Knowledge of how to validate technician access to EIS to perform smog check inspection.
93. Knowledge of reasons for verifying weight classification of vehicle.
94. Knowledge of reasons for performing pretest smog check inspection.
95. Knowledge of device(s) used to sample vehicle exhaust system.
96. Knowledge of how to perform acceleration simulation mode (ASM) test.
97. Knowledge of how to determine placement of vehicle on dynamometer.
98. Knowledge of equipment and procedures used to secure vehicle onto dynamometer.
99. Knowledge of reasons for securing vehicle onto dynamometer.
100. Knowledge of how to keep vehicle speed stabilized during acceleration simulation mode (ASM) test.
101. Knowledge of how to prevent vehicle from overheating during an acceleration simulation mode (ASM) test.
102. Knowledge of reasons for assessing vehicle prior to placing on dynamometer.
103. Knowledge of how to weigh vehicle on dynamometer.
104. Knowledge of reasons for weighing vehicle on dynamometer.

VI. Visual Inspection (18%)

This areas assess the candidate's ability to perform a comprehensive visual inspection by identifying the condition of required emission-related components.

TASKS

56. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.

ASSOCIATED KNOWLEDGE

105. Knowledge of references (e.g., CARB, Appendix K) used to identify approved replacement emission components.

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

57. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.
58. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.
59. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related components on vehicle.
60. Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.
61. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.
62. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.
63. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.
64. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.
65. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.
66. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on vehicle.
67. Perform visual smoke test.
68. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.
106. Knowledge of references used to identify required emission controlled components of a vehicle.
107. Knowledge of how to identify liquid fuel leaks.
108. Knowledge of how to verify vehicle emission components.
109. Knowledge of how to evaluate fuel induction system.
110. Knowledge of reasons for identifying liquid fuel leaks.
111. Knowledge of how to verify condition of fuel injection system.
112. Knowledge of fuel induction system components.
113. Knowledge of procedures used to perform visible smoke test.
114. Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.
115. Knowledge of references used to identify other vehicle emissions related components that are permitted in vehicle.
116. Knowledge of sensors, switches, and computers in vehicle.
117. Knowledge of how to verify condition of carburetor in fuel induction system.
118. Knowledge of ignition spark control system(s).
119. Knowledge of how to identify installation of other vehicle emission related components.
120. Knowledge of air injection (AIS) system components.
121. Knowledge of positive crankcase ventilation (PCV) system components.
122. Knowledge of references used to identify sensors, switches, and computers of vehicle.
123. Knowledge of references used to identify components of the fuel induction system.
124. Knowledge of references used to identify components of the ignition spark control system(s).

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

125. Knowledge of how to evaluate ignition spark control system(s).
126. Knowledge of how to verify condition of TCS switches in ignition spark control system(s).
127. Knowledge of how to verify condition of sensors in ignition spark control system(s).
128. Knowledge of how to evaluate air injection (AIS) system.
129. Knowledge of how to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.
130. Knowledge of how to evaluate catalytic converter system.
131. Knowledge of fuel evaporative (EVAP) system components.
132. Knowledge of how to verify condition of hoses in fuel induction system.
133. Knowledge of how to verify condition of sensors.
134. Knowledge of how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.
135. Knowledge of how to evaluate exhaust gas recirculation (EGR) system.
136. Knowledge of how to evaluate fuel evaporative (EVAP) system.
137. Knowledge of how to verify condition of wiring.
138. Knowledge of how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.
139. Knowledge of how to verify condition of wiring in fuel induction system.
140. Knowledge of exhaust gas recirculation (EGR) system components.
141. Knowledge of how to verify condition of spark delay valves in ignition spark control system(s).
142. Knowledge of how to verify condition of speed switches in exhaust gas recirculation (EGR) system.
143. Knowledge of how to verify condition of electrical components in air injection (AIS) system.

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

144. Knowledge of how to evaluate positive crankcase ventilation (PCV) system.
145. Knowledge of how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system.
146. Knowledge of how to verify condition of vapor storage canister in fuel evaporative (EVAP) system.
147. Knowledge of how to evaluate sensors, switches, and computers.
148. Knowledge of how to verify condition of air pump in air injection (AIS) system.
149. Knowledge of how to verify condition of valve(s) in positive crankcase ventilation (PCV) system.
150. Knowledge of how to evaluate thermostatic air cleaner (TAC) system.
151. Knowledge of references used to identify components of the exhaust gas recirculation (EGR) system.
152. Knowledge of how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system.
153. Knowledge of how to verify condition of valve(s) in air injection (AIS) system.
154. Knowledge of how to verify condition of vacuum signal lines in air injection (AIS) system.
155. Knowledge of how to verify type of fuel tank cap in fuel evaporative (EVAP) system.
156. Knowledge of how to verify condition of solenoids in fuel evaporative (EVAP) system.
157. Knowledge of external damage to catalytic converter system.
158. Knowledge of how to verify condition of thermal vacuum switches in ignition spark control system(s).
159. Knowledge of how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system.
160. Knowledge of how to verify condition of hoses in fuel evaporative (EVAP) system.
161. Knowledge of references used to identify

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

components of the fuel evaporative (EVAP) system.
162. Knowledge of references used to identify components of the air injection (AIS) system.
163. Knowledge of references used to identify components of the thermostatic air cleaner (TAC) system.
164. Knowledge of how to verify condition of heat delivery pipes in thermostatic air cleaner (TAC) system.
165. Knowledge of thermostatic air cleaner (TAC) system components.
166. Knowledge of how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system.
167. Knowledge of how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system.
168. Knowledge of how to verify condition of heat stoves in thermostatic air cleaner (TAC) system.
169. Knowledge of how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.
170. Knowledge of how to verify condition of required hoses in positive crankcase ventilation (PCV) system.
171. Knowledge of how to verify routing of distribution hoses in air injection (AIS) system.
172. Knowledge of references used to identify components of the positive crankcase ventilation (PCV) system.

VII. Functional Test(s) (6%)

This areas assess the candidate's ability to use correct procedures for testing the functional operation of emissions-related components.

TASKS

69. Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.

ASSOCIATED KNOWLEDGE

173. Knowledge of how to verify function of exhaust gas recirculation (EGR) system.
174. Knowledge of how to perform LPFET test.
175. Knowledge of vehicle ignition timing

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

70. Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.
71. Evaluate vehicle's malfunction indicator light (MIL) by performing functional test.
72. Perform and evaluate LPFET test on vehicle.
73. Perform fuel cap functional test.
74. Perform OBDII test as prompted by the analyzer to determine vehicle readiness indicator and code status.
75. Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.

parameters indicating smog check inspection failure.
176. Knowledge of vehicles that require LPFET test.
177. Knowledge of the purpose for performing LPFET test.
178. Knowledge of how to verify vehicle ignition timing.
179. Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.
180. Knowledge of vehicles that are exempt from ignition timing functional test.
181. Knowledge of how to perform fuel cap functional test.
182. Knowledge of procedures for performing OBD II functional test.
183. Knowledge of reasons for performing ignition timing functional test.
184. Knowledge of how to verify function of malfunction indicator light (MIL).
185. Knowledge of reasons for performing OBD II functional test.
186. Knowledge of reasons for performing exhaust gas recirculation (EGR) functional test.
187. Knowledge of reasons for performing fuel cap functional test.
188. Knowledge of vehicles that require fuel cap functional test.
189. Knowledge of reasons for performing fillpipe restrictor functional test.
190. Knowledge of how to verify function of fillpipe restrictors.

VIII. Diagnosis (16%)

This areas assess the candidate's ability to perform diagnostic testing procedures to determine the cause of a vehicle's smog check inspection failure.

TASKS

76. Evaluate emissions results (e.g., excessive HC, excessive CO) to identify vehicle system(s) that need diagnostic testing.
77. Evaluate vehicle to determine if failure was due to physical condition or tampering with.

ASSOCIATED KNOWLEDGE

191. Knowledge of how to interpret diagnostic readings.
192. Knowledge of how to perform onboard diagnostic testing.
193. Knowledge of how to interpret vehicle

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

78. Perform diagnostic testing on vehicle system(s) that indicate failure during smog check inspection to identify areas of repair.
79. Evaluate diagnostic readings to determine if a system failure in a vehicle may be causing other systems to fail.
80. Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.
81. Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to performing diagnostic testing.

inspection report (VIR) results.
194. Knowledge of interpreting diagnostic testing results indicating vehicle system failures impacting other systems.
195. Knowledge of how to diagnose catalytic converter system.
196. Knowledge of equipment used to perform diagnostic testing procedures.
197. Knowledge of how to verify the condition of engine mechanical systems.
198. Knowledge of relationships between vehicle systems.
199. Knowledge of components of vehicle systems that may have been tampered with.
200. Knowledge of components of vehicle systems that may have been damaged.
201. Knowledge of mechanical components that need repair or replacement.
202. Knowledge of hydrocarbon (HC) emission levels.
203. Knowledge of carbon monoxide (CO) emission levels.
204. Knowledge of oxides of nitrogen (NOx) emission levels.
205. Knowledge of how to diagnose fuel induction system.
206. Knowledge of how to diagnose exhaust gas recirculation (EGR) system.
207. Knowledge of references used when performing diagnostic testing on a vehicle.
208. Knowledge of how to diagnose sensors, switches, and computers.
209. Knowledge of oxygen (O2) emission levels.
210. Knowledge of carbon dioxide (CO2) emission levels.
211. Knowledge of how to diagnose evaporative (EVAP) system.
212. Knowledge of information indicated on vehicle inspection report (VIR).
213. Knowledge of how to verify condition of vehicle catalytic converter system.
214. Knowledge of how to verify condition of vehicle fuel induction system.
215. Knowledge of emissions that are considered

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1 Advanced Technicians in Test and Repair Stations	
	hazardous. 216. Knowledge of how to diagnose ignition spark control system(s). 217. Knowledge of references used to verify vehicle systems condition. 218. Knowledge of how to verify condition of vehicle exhaust gas recirculation (EGR) system. 219. Knowledge of how to diagnose other related emissions components. 220. Knowledge of references used when evaluating vehicle inspection report (VIR). 221. Knowledge of how to diagnose positive crankcase ventilation (PCV) system. 222. Knowledge of how to verify condition of vehicle sensors, switches, and computers. 223. Knowledge of how to verify condition of vehicle evaporative (EVAP) system. 224. Knowledge of how to verify condition of other related emissions components. 225. Knowledge of how to diagnose air injection (AIS) system. 226. Knowledge of how to diagnose thermostatic air cleaner (TAC) system. 227. Knowledge of how to verify condition of vehicle ignition spark control system(s). 228. Knowledge of how to verify condition of vehicle air injection (AIS) system. 229. Knowledge of reasons for performing a baseline test prior to diagnosing a vehicle. 230. Knowledge of how to verify condition of vehicle thermostatic air cleaner (TAC) system. 231. Knowledge of how to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems. 232. Knowledge of how to verify condition of vehicle positive crankcase ventilation (PCV) system. 233. Knowledge of how to perform a baseline test prior to diagnosing a vehicle.
IX. Performing and Verifying Repairs (11%)	

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1
Advanced Technicians in Test and Repair Stations

This areas assess the candidate's ability to perform repairs on emissions-related components and verify the effectiveness of the repairs.

TASKS

82. Perform after repair smog check inspection to determine if repair of vehicle is successful.
83. Evaluate diagnostic testing results to determine if components of vehicle system(s) need to be cleaned, repaired, or replaced.
84. Replace components of vehicle system(s) as indicated by vehicle diagnosis.
85. Repair components of vehicle system(s) as indicated by vehicle diagnosis.
86. Clean out components of vehicle system(s) as indicated by vehicle diagnosis.

ASSOCIATED KNOWLEDGE

234. Knowledge of catalytic converter system components that need replacement.
235. Knowledge of how to verify vehicle systems repairs.
236. Knowledge of sensor, switch, and computer components that need replacement.
237. Knowledge of vehicle system components that need repair.
238. Knowledge of evaporative (EVAP) system components that need repair.
239. Knowledge of components of exhaust gas recirculation (EGR) system that need repair.
240 Knowledge of sensor, switch, and computer components that need repair.
241. Knowledge of ignition spark control system components that need replacement.
242. Knowledge of ignition spark control system components that need repair.
243. Knowledge of exhaust gas recirculation (EGR) system components that need replacement.
244. Knowledge of how to determine type of vehicle repair to be performed.
245. Knowledge of how to repair vehicle system(s).
246. Knowledge of air injection (AIS) system components that need repair.
247. Knowledge of catalytic converter system components that need repair.
248. Knowledge of how to determine if components of vehicle need to be cleaned, repaired, or replaced.
249. Knowledge of other related vehicle components that need repair.
250. Knowledge of vehicle system components that need replacement.
251. Knowledge of fuel induction system components that need repair.
252. Knowledge of fuel induction system components that need replacement.

Table 7. Exam Outline for Advanced Technicians in Test and Repair Stations

ATR Exam Outline No. 1 Advanced Technicians in Test and Repair Stations	
	253. Knowledge of thermostatic air cleaner (TAC) system components that need repair. 254. Knowledge of air injection (AIS) system components need replacement. 255. Knowledge of references used to assist technician in performing repairs to a vehicle. 256. Knowledge of evaporative (EVAP) system components that need replacement. 257. Knowledge of how to differentiate between minor and major vehicle repairs. 258. Knowledge of how to perform an "after repair" smog check inspection. 259. Knowledge of positive crankcase ventilation (PCV) system components that need repair. 260. Knowledge of procedures and equipment used to clean out components of vehicle system(s). 261. Knowledge of other related vehicle components that need replacement. 262. Knowledge of positive crankcase ventilation (PCV) system components that need replacement. 263. Knowledge of how to replace components of vehicle systems. 264. Knowledge of equipment used to repair vehicle system(s). 265. Knowledge of thermostatic air cleaner (TAC) system components that need replacement. 266. Knowledge of reasons for performing an "after repair" smog check inspection. 267. Knowledge of equipment used to replace vehicle system(s).

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

I.a Consumer Consultation (10%)

This area assess the candidate's ability to consult with the consumer about authorization to perform smog check inspections according to state law and regulations.

TASKS

1. Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.
2. Inform the consumer about the smog check results by explaining the vehicle inspection report (VIR).
3. Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.
4. Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.
5. Prepare work order for consumer to document smog check inspection to be performed.
6. Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.
7. Consult with customer regarding regulations on catalyst replacement.
8. Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.
9. Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.
10. Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.
11. Provide consumer with list of stations authorized to diagnose and repair vehicles.
12. Inform consumer of the option and scope of a pretest smog check inspection to

ASSOCIATED KNOWLEDGE

1. Knowledge of reasons for obtaining consumer authorization before performing smog check inspection.
2. Knowledge of information to provide on work orders for smog check inspection.
3. Knowledge of type of information provided in vehicle inspection report (VIR).
4. Knowledge of types of procedure(s) performed during smog check inspection.
5. Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
6. Knowledge of how to prepare work orders for smog check inspection.
7. Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
8. Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.
9. Knowledge of laws and regulations regarding performing minor repairs on vehicles.
10. Knowledge of laws and regulations for informing consumers about catalytic replacement.
11. Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
12. Knowledge of reasons for performing minor repairs on vehicles.
13. Knowledge of how to determine if vehicle needs minor repairs before performing smog check inspection.
14. Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).
15. Knowledge of reasons for performing smog

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

determine if consumer wants an inspection performed.	check inspection on vehicles. 16. Knowledge of reasons for referring consumers to referee stations (e.g., engine change, SPCNS). 17. Knowledge of laws and regulations requiring vehicles to be tested at a test only station. 18. Knowledge of reasons for providing consumer with vehicle inspection report (VIR). 19. Knowledge of how to determine if a vehicle requires smog check inspection. 20. Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles. 21. Knowledge of how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution). 22. Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection. 23. Knowledge of how to inform consumer about the option and scope of a pretest smog check inspection. 24. Knowledge of procedures used to determine if a consumer wants pretest smog check inspection. 25. Knowledge of how to inform consumers of contact information for stations that diagnose and repair vehicles. 26. Knowledge of how to obtain information from consumers regarding type of smog check inspection needed.

I.b Consumer Consultation – Diagnosis + Repair Related (7%)

This area assess the candidate's ability to consult with the consumer about reasons for performing diagnostic testing and the authorization to perform smog system repairs.

TASKS	ASSOCIATED KNOWLEDGE
13. Provide consumer with a vehicle repair cost estimate documenting recommended vehicle repairs following diagnostic testing procedures.	27. Knowledge of laws and regulations regarding performing repairs on vehicles. 28. Knowledge of laws and regulations requiring consumer authorization for performing

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

14. Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.
15. Consult with consumer regarding diagnostic testing if vehicle fails smog check inspection.
16. Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.
17. Consult with consumer to determine if vehicle repairs may be covered under warranty prior to performing repairs.
18. Consult with consumer regarding the retest procedures of a vehicle following repairs made to vehicle.
19. Consult with consumer to determine if vehicle requires testing at a test only station prior to performing smog check inspection.

repairs on vehicles.

29. Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates.
30. Knowledge of laws and regulations about performing diagnostic testing on vehicles.
31. Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles.
32. Knowledge of reasons for performing diagnostic testing on vehicles.
33. Knowledge of reasons for conducting retest procedures on a vehicle following repairs.
34. Knowledge of reasons for performing repairs on vehicles.
35. Knowledge of information provided in vehicle repair cost estimates.
36. Knowledge of how to develop repair cost estimates for a vehicle.
37. Knowledge of how to determine if vehicle repairs are covered under warranty.
38. Knowledge of how to recommend vehicle repairs to consumers.
39. Knowledge of how to obtain information from consumer regarding warranty of vehicle.
40. Knowledge of information to provide consumers about components of a vehicle that may need repair in the future.
41. Knowledge of how to determine if smog check inspection of a vehicle needs to be performed at Test Only or Gold Shield station.
42. Knowledge of information to provide consumers about retesting a vehicle following repairs.

II. Vehicle Identification (6%)

This area assess the candidate's ability to identify the vehicle to be tested.

TASKS

20. Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements.

ASSOCIATED KNOWLEDGE

43. Knowledge of how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label.

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

21. Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license number) to determine accuracy of information prior to performing smog check inspection.
22. Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).
23. Evaluate documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).
44. Knowledge of information used to determine when vehicle does not conform to emissions certifications (i.e., Gray Market).
45. Knowledge of how to verify vehicle information prior to performing smog check inspection.
46. Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).
47. Knowledge of how to determine type of vehicle certification (e.g., California, Federal, BAR label).
48. Knowledge of how to verify accuracy of consumer's DMV renewal notice.

III. Safety Precautions (8%)

This areas assess the candidate's ability to identify and determine whether the vehicle presented for testing has any conditions that would render emissions testing problematic and/or unsafe.

TASKS

24. Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) prior to performing smog check inspection.
25. Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.
26. Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.
27. Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing smog check inspection.
28. Maintain safety of testing area by keeping area clean.
29. Consult with consumer for authorization to perform minor repair(s) (e.g., loose hose clamp) on vehicle to ensure safety during smog check inspection.
30. Perform minor repair(s) (e.g., tighten loose

ASSOCIATED KNOWLEDGE

49. Knowledge of how to identify unsafe vehicle conditions.
50. Knowledge of how to operate equipment during smog check inspection.
51. Knowledge of how to ensure technician safety while operating equipment during smog check inspection.
52. Knowledge of laws and regulations about stations performing repairs on vehicles to ensure safe test conditions.
53. Knowledge of information to provide consumers about unsafe vehicle condition(s).
54. Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.
55. Knowledge of how to inspect the condition of a vehicle.
56. Knowledge of reasons for verifying vehicle safety prior to performing smog check inspection.
57. Knowledge of how to determine when smog check inspection needs to be aborted.

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

hose clamp) on vehicle if needed during safety inspection.

58. Knowledge of equipment used during smog check inspection that could harm consumer, staff, and technician.
59. Knowledge of how to maintain consumer and staff safety while conducting smog check inspection.
60. Knowledge of reasons for performing minor repairs to a vehicle during safety check.
61. Knowledge of references used to inform technician of equipment operation.
62. Knowledge of the requirements for maintaining a clean smog check test area.

IV. Calibration of Analyzer and Devices (4%)

This areas assess the candidate's ability to interpret and respond to analyzer prompts, maintain or troubleshoot analyzer system malfunctions and perform required analyzer service procedures.

TASKS

31. Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.
32. Perform visual inspection of analyzer components (i.e., RPM pickup) to ensure accurate functioning during smog check inspection.
33. Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.
34. Perform troubleshooting procedures on analyzer sample system to restore function of system.
35. Perform troubleshooting procedures on LPFET analyzer to restore function to system.
36. Perform troubleshooting procedures on fuel cap test devices to restore function of system.

ASSOCIATED KNOWLEDGE

63. Knowledge of procedures used to calibrate LPFET analyzer.
64. Knowledge of LPFET analyzer upload.
65. Knowledge of analyzer components(s) (i.e., RPM pickup, exhaust probe) used during smog check inspection.
66. Knowledge of how to inspect analyzer maintenance components for possible replacement.
67. Knowledge of how to verify function of analyzer component(s) (i.e., RPM, probe pickup).
68. Knowledge of how to verify function of fuel cap test device(s).
69. Knowledge of how to calibrate fuel cap test device(s).
70. Knowledge of how to troubleshoot analyzer system.
71. Knowledge of how to troubleshoot on-line phone connection.
72. Knowledge of references used by technician to troubleshoot analyzer system and components.
73. Knowledge of how to replace analyzer maintenance components.
74. Knowledge of how to troubleshoot fuel cap

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

integrity test device(s).

75. Knowledge of references used by technician to troubleshoot fuel cap test devices.

V. Emissions Test(s) Procedures (10%)

This areas assess the candidate's ability to use correct procedures for testing the functional operations of emissions-related components.

TASKS

39. Remove analyzer devices from vehicle following emissions test as prompted by analyzer.
40. Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.
41. Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.
42. Validate technician authorization to perform emissions test by entering access code into analyzer.
43. Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.
44. Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.
45. Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.
46. Prepare vehicle for LPFET test.
47. Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.
48. Perform LPFET test as required by vehicle type.
49. Secure vehicle during emissions test (e.g., two speed idle) by setting the emergency brake.
50. Perform pretest smog check inspection on vehicle if authorized by consumer.

ASSOCIATED KNOWLEDGE

80. Knowledge of procedures used to perform LPFET test.
81. Knowledge of how to prepare vehicle for performing an emissions test.
82. Knowledge of vehicle information used to prepare for an emissions test.
83. Knowledge of procedures used following the completion of emission(s) test.
84. Knowledge of how to secure vehicle while performing a two-speed idle test.
85. Knowledge of how to enter vehicle information.
86. Knowledge of how to perform two-speed idle (TSI) test.
87. Knowledge of reasons for selecting vehicle gear as prompted by analyzer.
88. Knowledge of reasons for warming vehicle engine prior to performing an emissions test.
89. Knowledge of how to verify weight classification of vehicle.
90. Knowledge of device(s) used to detect engine rpm.
91. Knowledge of how to perform pretest smog check inspection.
92. Knowledge of how to validate technician access to EIS to perform smog check inspection.
93. Knowledge of reasons for verifying weight classification of vehicle.
94. Knowledge of reasons for performing pretest smog check inspection.
95. Knowledge of device(s) used to sample vehicle exhaust system.

VI. Visual Inspection (20%)

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

This areas assess the candidate's ability to perform a comprehensive visual inspection by identifying the condition of required emission-related components.

TASKS

56. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.
57. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.
58. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.
59. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related components on vehicle.
60. Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.
61. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.
62. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.
63. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.
64. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.
65. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.
66. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on

ASSOCIATED KNOWLEDGE

105. Knowledge of references (e.g., CARB, Appendix K) used to identify approved replacement emission components.
106. Knowledge of references used to identify required emission controlled components of a vehicle.
107. Knowledge of how to identify liquid fuel leaks.
108. Knowledge of how to verify vehicle emission components.
109. Knowledge of how to evaluate fuel induction system.
110. Knowledge of reasons for identifying liquid fuel leaks.
111. Knowledge of how to verify condition of fuel injection system.
112. Knowledge of fuel induction system components.
113. Knowledge of procedures used to perform visible smoke test.
114. Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.
115. Knowledge of references used to identify other vehicle emissions related components that are permitted in vehicle.
116. Knowledge of sensors, switches, and computers in vehicle.
117. Knowledge of how to verify condition of carburetor in fuel induction system.
118. Knowledge of ignition spark control system(s).
119. Knowledge of how to identify installation of other vehicle emission related components.
120. Knowledge of air injection (AIS) system components.
121. Knowledge of positive crankcase ventilation (PCV) system components.
122. Knowledge of references used to identify

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

vehicle.

67. Perform visual smoke test.
68. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.

sensors, switches, and computers of vehicle.

123. Knowledge of references used to identify components of the fuel induction system.
124. Knowledge of references used to identify components of the ignition spark control system(s).
125. Knowledge of how to evaluate ignition spark control system(s).
126. Knowledge of how to verify condition of TCS switches in ignition spark control system(s).
127. Knowledge of how to verify condition of sensors in ignition spark control system(s).
128. Knowledge of how to evaluate air injection (AIS) system.
129. Knowledge of how to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.
130. Knowledge of how to evaluate catalytic converter system.
131. Knowledge of fuel evaporative (EVAP) system components.
132. Knowledge of how to verify condition of hoses in fuel induction system.
133. Knowledge of how to verify condition of sensors.
134. Knowledge of how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.
135. Knowledge of how to evaluate exhaust gas recirculation (EGR) system.
136. Knowledge of how to evaluate fuel evaporative (EVAP) system.
137. Knowledge of how to verify condition of wiring.
138. Knowledge of how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.
139. Knowledge of how to verify condition of wiring in fuel induction system.
140. Knowledge of exhaust gas recirculation (EGR) system components.
141. Knowledge of how to verify condition of spark delay valves in ignition spark control

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2 Basic Technicians in Test and Repair Stations

system(s).

142. Knowledge of how to verify condition of speed switches in exhaust gas recirculation (EGR) system.
143. Knowledge of how to verify condition of electrical components in air injection (AIS) system.
144. Knowledge of how to evaluate positive crankcase ventilation (PCV) system.
145. Knowledge of how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system.
146. Knowledge of how to verify condition of vapor storage canister in fuel evaporative (EVAP) system.
147. Knowledge of how to evaluate sensors, switches, and computers.
148. Knowledge of how to verify condition of air pump in air injection (AIS) system.
149. Knowledge of how to verify condition of valve(s) in positive crankcase ventilation (PCV) system.
150. Knowledge of how to evaluate thermostatic air cleaner (TAC) system.
151. Knowledge of references used to identify components of the exhaust gas recirculation (EGR) system.
152. Knowledge of how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system.
153. Knowledge of how to verify condition of valve(s) in air injection (AIS) system.
154. Knowledge of how to verify condition of vacuum signal lines in air injection (AIS) system.
155. Knowledge of how to verify type of fuel tank cap in fuel evaporative (EVAP) system.
156. Knowledge of how to verify condition of solenoids in fuel evaporative (EVAP) system.
157. Knowledge of external damage to catalytic converter system.
158. Knowledge of how to verify condition of thermal vacuum switches in ignition spark

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2 Basic Technicians in Test and Repair Stations	
	control system(s). 159. Knowledge of how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system. 160. Knowledge of how to verify condition of hoses in fuel evaporative (EVAP) system. 161. Knowledge of references used to identify components of the fuel evaporative (EVAP) system. 162. Knowledge of references used to identify components of the air injection (AIS) system. 163. Knowledge of references used to identify components of the thermostatic air cleaner (TAC) system. 164. Knowledge of how to verify condition of heat delivery pipes in thermostatic air cleaner (TAC) system. 165. Knowledge of thermostatic air cleaner (TAC) system components. 166. Knowledge of how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system. 167. Knowledge of how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system. 168. Knowledge of how to verify condition of heat stoves in thermostatic air cleaner (TAC) system. 169. Knowledge of how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system. 170. Knowledge of how to verify condition of required hoses in positive crankcase ventilation (PCV) system. 171. Knowledge of how to verify routing of distribution hoses in air injection (AIS) system. 172. Knowledge of references used to identify components of the positive crankcase ventilation (PCV) system.
VII. Functional Test(s) (6%)	

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

This areas assess the candidate's ability to use correct procedures for testing the functional operation of emissions-related components.

TASKS

69. Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.
70. Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.
71. Evaluate vehicle's malfunction indicator light (MIL) by performing functional test.
72. Perform and evaluate LPFET test on vehicle.
73. Perform fuel cap functional test.
74. Perform OBDII test as prompted by the analyzer to determine vehicle readiness indicator and code status.
75. Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.

ASSOCIATED KNOWLEDGE

173. Knowledge of how to verify function of exhaust gas recirculation (EGR) system.
174. Knowledge of how to perform LPFET test.
175. Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.
176. Knowledge of vehicles that require LPFET test.
177. Knowledge of the purpose for performing LPFET test.
178. Knowledge of how to verify vehicle ignition timing.
179. Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.
180. Knowledge of vehicles that are exempt from ignition timing functional test.
181. Knowledge of how to perform fuel cap functional test.
182. Knowledge of procedures for performing OBD II functional test.
183. Knowledge of reasons for performing ignition timing functional test.
184. Knowledge of how to verify function of malfunction indicator light (MIL).
185. Knowledge of reasons for performing OBD II functional test.
186. Knowledge of reasons for performing exhaust gas recirculation (EGR) functional test.
187. Knowledge of reasons for performing fuel cap functional test.
188. Knowledge of vehicles that require fuel cap functional test.
189. Knowledge of reasons for performing fillpipe restrictor functional test.
190. Knowledge of how to verify function of fillpipe restrictors.

VIII. Diagnosis (16%)

This areas assess the candidate's ability to perform diagnostic testing procedures to determine the

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

cause of a vehicle's smog check inspection failure.

TASKS

76. Evaluate emissions results (e.g., excessive HC, excessive CO) to identify vehicle system(s) that need diagnostic testing.
77. Evaluate vehicle to determine if failure was due to physical condition or tampering with.
78. Perform diagnostic testing on vehicle system(s) that indicate failure during smog check inspection to identify areas of repair.
79. Evaluate diagnostic readings to determine if a system failure in a vehicle may be causing other systems to fail.
80. Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.
81. Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to performing diagnostic testing.

ASSOCIATED KNOWLEDGE

191. Knowledge of how to interpret diagnostic readings.
192. Knowledge of how to perform onboard diagnostic testing.
193. Knowledge of how to interpret vehicle inspection report (VIR) results.
194. Knowledge of interpreting diagnostic testing results indicating vehicle system failures impacting other systems.
195. Knowledge of how to diagnose catalytic converter system.
196. Knowledge of equipment used to perform diagnostic testing procedures.
197. Knowledge of how to verify the condition of engine mechanical systems.
198. Knowledge of relationships between vehicle systems.
199. Knowledge of components of vehicle systems that may have been tampered with.
200. Knowledge of components of vehicle systems that may have been damaged.
201. Knowledge of mechanical components that need repair or replacement.
202. Knowledge of hydrocarbon (HC) emission levels.
203. Knowledge of carbon monoxide (CO) emission levels.
204. Knowledge of oxides of nitrogen (NOx) emission levels.
205. Knowledge of how to diagnose fuel induction system.
206. Knowledge of how to diagnose exhaust gas recirculation (EGR) system.
207. Knowledge of references used when performing diagnostic testing on a vehicle.
208. Knowledge of how to diagnose sensors, switches, and computers.
209. Knowledge of oxygen (O2) emission levels.
210. Knowledge of carbon dioxide (CO2) emission levels.
211. Knowledge of how to diagnose evaporative

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2 Basic Technicians in Test and Repair Stations	
	(EVAP) system. 212. Knowledge of information indicated on vehicle inspection report (VIR). 213. Knowledge of how to verify condition of vehicle catalytic converter system. 214. Knowledge of how to verify condition of vehicle fuel induction system. 215. Knowledge of emissions that are considered hazardous. 216. Knowledge of how to diagnose ignition spark control system(s). 217. Knowledge of references used to verify vehicle systems condition. 218. Knowledge of how to verify condition of vehicle exhaust gas recirculation (EGR) system. 219. Knowledge of how to diagnose other related emissions components. 220. Knowledge of references used when evaluating vehicle inspection report (VIR). 221. Knowledge of how to diagnose positive crankcase ventilation (PCV) system. 222. Knowledge of how to verify condition of vehicle sensors, switches, and computers. 223. Knowledge of how to verify condition of vehicle evaporative (EVAP) system. 224. Knowledge of how to verify condition of other related emissions components. 225. Knowledge of how to diagnose air injection (AIS) system. 226. Knowledge of how to diagnose thermostatic air cleaner (TAC) system. 227. Knowledge of how to verify condition of vehicle ignition spark control system(s). 228. Knowledge of how to verify condition of vehicle air injection (AIS) system. 229. Knowledge of reasons for performing a baseline test prior to diagnosing a vehicle. 230. Knowledge of how to verify condition of vehicle thermostatic air cleaner (TAC) system. 231. Knowledge of how to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems.

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2
Basic Technicians in Test and Repair Stations

232. Knowledge of how to verify condition of vehicle positive crankcase ventilation (PCV) system.
233. Knowledge of how to perform a baseline test prior to diagnosing a vehicle.

IX. Performing and Verifying Repairs (12%)

This areas assess the candidate's ability to perform repairs on emissions-related components and verify the effectiveness of the repairs.

TASKS

82. Perform after repair smog check inspection to determine if repair of vehicle is successful.
83. Evaluate diagnostic testing results to determine if components of vehicle system(s) need to be cleaned, repaired, or replaced.
84. Replace components of vehicle system(s) as indicated by vehicle diagnosis.
85. Repair components of vehicle system(s) as indicated by vehicle diagnosis.
86. Clean out components of vehicle system(s) as indicated by vehicle diagnosis.

ASSOCIATED KNOWLEDGE

234. Knowledge of catalytic converter system components that need replacement.
235. Knowledge of how to verify vehicle systems repairs.
236. Knowledge of sensor, switch, and computer components that need replacement.
237. Knowledge of vehicle system components that need repair.
238. Knowledge of evaporative (EVAP) system components that need repair.
239. Knowledge of components of exhaust gas recirculation (EGR) system that need repair.
240 Knowledge of sensor, switch, and computer components that need repair.
241. Knowledge of ignition spark control system components that need replacement.
242. Knowledge of ignition spark control system components that need repair.
243. Knowledge of exhaust gas recirculation (EGR) system components that need replacement.
244. Knowledge of how to determine type of vehicle repair to be performed.
245. Knowledge of how to repair vehicle system(s).
246. Knowledge of air injection (AIS) system components that need repair.
247. Knowledge of catalytic converter system components that need repair.
248. Knowledge of how to determine if components of vehicle need to be cleaned, repaired, or replaced.
249. Knowledge of other related vehicle

Table 8. Exam Outline for Basic Technicians in Test and Repair Stations

BTR Exam Outline No. 2 Basic Technicians in Test and Repair Stations
components that need repair. 250. Knowledge of vehicle system components that need replacement. 251. Knowledge of fuel induction system components that need repair. 252. Knowledge of fuel induction system components that need replacement. 253. Knowledge of thermostatic air cleaner (TAC) system components that need repair. 254. Knowledge of air injection (AIS) system components need replacement. 255. Knowledge of references used to assist technician in performing repairs to a vehicle. 256. Knowledge of evaporative (EVAP) system components that need replacement. 257. Knowledge of how to differentiate between minor and major vehicle repairs. 258. Knowledge of how to perform an "after repair" smog check inspection. 259. Knowledge of positive crankcase ventilation (PCV) system components that need repair. 260. Knowledge of procedures and equipment used to clean out components of vehicle system(s). 261. Knowledge of other related vehicle components that need replacement. 262. Knowledge of positive crankcase ventilation (PCV) system components that need replacement. 263. Knowledge of how to replace components of vehicle systems. 264. Knowledge of equipment used to repair vehicle system(s). 265. Knowledge of thermostatic air cleaner (TAC) system components that need replacement. 266. Knowledge of reasons for performing an "after repair" smog check inspection. 267. Knowledge of equipment used to replace vehicle system(s).

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3
Advanced Technicians in Test Only Stations

I. Consumer Consultation (15%)

This area assess the candidate's ability to consult with the consumer about authorization to perform smog check inspections according to state law and regulations.

TASKS

1. Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.
2. Inform the consumer about the smog check results by explaining the vehicle inspection report (VIR).
3. Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.
4. Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.
5. Prepare work order for consumer to document smog check inspection to be performed.
6. Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.
7. Consult with customer regarding regulations on catalyst replacement.
8. Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.
9. Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.
10. Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.
11. Provide consumer with list of stations authorized to diagnose and repair vehicles.
12. Inform consumer of the option and scope of a pretest smog check inspection to

ASSOCIATED KNOWLEDGE

1. Knowledge of reasons for obtaining consumer authorization before performing smog check inspection.
2. Knowledge of information to provide on work orders for smog check inspection.
3. Knowledge of type of information provided in vehicle inspection report (VIR).
4. Knowledge of types of procedure(s) performed during smog check inspection.
5. Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
6. Knowledge of how to prepare work orders for smog check inspection.
7. Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
8. Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.
9. Knowledge of laws and regulations regarding performing minor repairs on vehicles.
10. Knowledge of laws and regulations for informing consumers about catalytic replacement.
11. Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
12. Knowledge of reasons for performing minor repairs on vehicles.
13. Knowledge of how to determine if vehicle needs minor repairs before performing smog check inspection.
14. Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).
15. Knowledge of reasons for performing smog

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3
Advanced Technicians in Test Only Stations

determine if consumer wants an inspection performed.	check inspection on vehicles. 16. Knowledge of reasons for referring consumers to referee stations (e.g., engine change, SPCNS). 17. Knowledge of laws and regulations requiring vehicles to be tested at a test only station. 18. Knowledge of reasons for providing consumer with vehicle inspection report (VIR). 19. Knowledge of how to determine if a vehicle requires smog check inspection. 20. Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles. 21. Knowledge of how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution). 22. Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection. 23. Knowledge of how to inform consumer about the option and scope of a pretest smog check inspection. 24. Knowledge of procedures used to determine if a consumer wants pretest smog check inspection. 25. Knowledge of how to inform consumers of contact information for stations that diagnose and repair vehicles. 26. Knowledge of how to obtain information from consumers regarding type of smog check inspection needed.

II. Vehicle Identification (8%)

This area assess the candidate's ability to identify the vehicle to be tested.

TASKS	ASSOCIATED KNOWLEDGE
20. Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements. 21. Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license	43. Knowledge of how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label. 44. Knowledge of information used to determine when vehicle does not conform to emissions

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number) to determine accuracy of information prior to performing smog check inspection.
22. Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).
23. Evaluate documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).

certifications (i.e., Gray Market).
45. Knowledge of how to verify vehicle information prior to performing smog check inspection.
46. Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).
47. Knowledge of how to determine type of vehicle certification (e.g., California, Federal, BAR label).
48. Knowledge of how to verify accuracy of consumer's DMV renewal notice.

III. Safety Precautions (11%)

This areas assess the candidate's ability to identify and determine whether the vehicle presented for testing has any conditions that would render emissions testing problematic and/or unsafe.

TASKS

24. Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) prior to performing smog check inspection.
25. Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.
26. Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.
27. Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing smog check inspection.
28. Maintain safety of testing area by keeping area clean.
29. Consult with consumer for authorization to perform minor repair(s) (e.g., loose hose clamp) on vehicle to ensure safety during smog check inspection.
30. Perform minor repair(s) (e.g., tighten loose hose clamp) on vehicle if needed during safety inspection.

ASSOCIATED KNOWLEDGE

49. Knowledge of how to identify unsafe vehicle conditions.
50. Knowledge of how to operate equipment during smog check inspection.
51. Knowledge of how to ensure technician safety while operating equipment during smog check inspection.
52. Knowledge of laws and regulations about stations performing repairs on vehicles to ensure safe test conditions.
53. Knowledge of information to provide consumers about unsafe vehicle condition(s).
54. Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.
55. Knowledge of how to inspect the condition of a vehicle.
56. Knowledge of reasons for verifying vehicle safety prior to performing smog check inspection.
57. Knowledge of how to determine when smog check inspection needs to be aborted.
58. Knowledge of equipment used during smog check inspection that could harm consumer,

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

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Advanced Technicians in Test Only Stations

staff, and technician.
59. Knowledge of how to maintain consumer and staff safety while conducting smog check inspection.
60. Knowledge of reasons for performing minor repairs to a vehicle during safety check.
61. Knowledge of references used to inform technician of equipment operation.
62. Knowledge of the requirements for maintaining a clean smog check test area.

IV. Calibration of Analyzer and Devices (7%)

This areas assess the candidate's ability to interpret and respond to analyzer prompts, maintain or troubleshoot analyzer system malfunctions and perform required analyzer service procedures (including dynamometer).

TASKS

31. Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.
32. Perform visual inspection of analyzer components (i.e., RPM pickup) to ensure accurate functioning during smog check inspection.
33. Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.
34. Perform troubleshooting procedures on analyzer sample system to restore function of system.
35. Perform troubleshooting procedures on LPFET analyzer to restore function to system.
36. Perform troubleshooting procedures on fuel cap test devices to restore function of system.
37. Inspect dynamometer to ensure safe operation prior to performing calibration.
38. Perform troubleshooting procedures on dynamometer to restore function of system.

ASSOCIATED KNOWLEDGE

63. Knowledge of procedures used to calibrate LPFET analyzer.
64. Knowledge of LPFET analyzer upload.
65. Knowledge of analyzer components(s) (i.e., RPM pickup, exhaust probe) used during smog check inspection.
66. Knowledge of how to inspect analyzer maintenance components for possible replacement.
67. Knowledge of how to verify function of analyzer component(s) (i.e., RPM, probe pickup).
68. Knowledge of how to verify function of fuel cap test device(s).
69. Knowledge of how to calibrate fuel cap test device(s).
70. Knowledge of how to troubleshoot analyzer system.
71. Knowledge of how to troubleshoot on-line phone connection.
72. Knowledge of references used by technician to troubleshoot analyzer system and components.
73. Knowledge of how to replace analyzer maintenance components.
74. Knowledge of how to troubleshoot fuel cap integrity test device(s).

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Advanced Technicians in Test Only Stations

75. Knowledge of references used by technician to troubleshoot fuel cap test devices.
76. Knowledge of how to verify operation of dynamometer.
77. Knowledge of how to troubleshoot dynamometer.
78. Knowledge of references used by technician to troubleshoot dynamometer.
79. Knowledge of components of a dynamometer.

V. Emissions Test(s) Procedures (21%)

This areas assess the candidate's ability to use correct procedures for testing the functional operations of emissions-related components (including dynamometer).

TASKS

39. Remove analyzer devices from vehicle following emissions test as prompted by analyzer.
40. Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.
41. Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.
42. Validate technician authorization to perform emissions test by entering access code into analyzer.
43. Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.
44. Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.
45. Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.
46. Prepare vehicle for LPFET test.
47. Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.
48. Perform LPFET test as required by vehicle type.
49. Secure vehicle during emissions test (e.g.,

ASSOCIATED KNOWLEDGE

80. Knowledge of procedures used to perform LPFET test.
81. Knowledge of how to prepare vehicle for performing an emissions test.
82. Knowledge of vehicle information used to prepare for an emissions test.
83. Knowledge of procedures used following the completion of emission(s) test.
84. Knowledge of how to secure vehicle while performing a two-speed idle test.
85. Knowledge of how to enter vehicle information.
86. Knowledge of how to perform two-speed idle (TSI) test.
87. Knowledge of reasons for selecting vehicle gear as prompted by analyzer.
88. Knowledge of reasons for warming vehicle engine prior to performing an emissions test.
89. Knowledge of how to verify weight classification of vehicle.
90. Knowledge of device(s) used to detect engine rpm.
91. Knowledge of how to perform pretest smog check inspection.
92. Knowledge of how to validate technician access to EIS to perform smog check inspection.
93. Knowledge of reasons for verifying weight

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

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two speed idle) by setting the emergency brake.
50. Perform pretest smog check inspection on vehicle if authorized by consumer.
51. Prepare vehicle for emissions test by securing vehicle onto dynamometer (e.g., blocks, straps).
52. Perform acceleration simulation mode (ASM) test as prompted by analyzer to evaluate vehicle emissions.
53. Evaluate vehicle (e.g., front wheel drive, rear wheel drive) to determine placement of vehicle on dynamometer prior to performing emissions test.
54. Weigh vehicle prior to performing emissions test to set load of dynamometer.
55. Prepare vehicle for emissions test by operating cooling fan to prevent overheating of vehicle during ASM emissions test as prompted by analyzer.

classification of vehicle.
94. Knowledge of reasons for performing pretest smog check inspection.
95. Knowledge of device(s) used to sample vehicle exhaust system.
96. Knowledge of how to perform acceleration simulation mode (ASM) test.
97. Knowledge of how to determine placement of vehicle on dynamometer.
98. Knowledge of equipment and procedures used to secure vehicle onto dynamometer.
99. Knowledge of reasons for securing vehicle onto dynamometer.
100. Knowledge of how to keep vehicle speed stabilized during acceleration simulation mode (ASM) test.
101. Knowledge of how to prevent vehicle from overheating during an acceleration simulation mode (ASM) test.
102. Knowledge of reasons for assessing vehicle prior to placing on dynamometer.
103. Knowledge of how to weigh vehicle on dynamometer.
104. Knowledge of reasons for weighing vehicle on dynamometer.

VI. Visual Inspection (29%)

This areas assess the candidate's ability to perform a comprehensive visual inspection by identifying the condition of required emission-related components.

TASKS

56. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.
57. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.
58. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.
59. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related

ASSOCIATED KNOWLEDGE

105. Knowledge of references (e.g., CARB, Appendix K) used to identify approved replacement emission components.
106. Knowledge of references used to identify required emission controlled components of a vehicle.
107. Knowledge of how to identify liquid fuel leaks.
108. Knowledge of how to verify vehicle emission components.
109. Knowledge of how to evaluate fuel induction system.
110. Knowledge of reasons for identifying liquid

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3
Advanced Technicians in Test Only Stations

components on vehicle.

60. Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.
61. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.
62. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.
63. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.
64. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.
65. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.
66. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on vehicle.
67. Perform visual smoke test.
68. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.

fuel leaks.

111. Knowledge of how to verify condition of fuel injection system.
112. Knowledge of fuel induction system components.
113. Knowledge of procedures used to perform visible smoke test.
114. Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.
115. Knowledge of references used to identify other vehicle emissions related components that are permitted in vehicle.
116. Knowledge of sensors, switches, and computers in vehicle.
117. Knowledge of how to verify condition of carburetor in fuel induction system.
118. Knowledge of ignition spark control system(s).
119. Knowledge of how to identify installation of other vehicle emission related components.
120. Knowledge of air injection (AIS) system components.
121. Knowledge of positive crankcase ventilation (PCV) system components.
122. Knowledge of references used to identify sensors, switches, and computers of vehicle.
123. Knowledge of references used to identify components of the fuel induction system.
124. Knowledge of references used to identify components of the ignition spark control system(s).
125. Knowledge of how to evaluate ignition spark control system(s).
126. Knowledge of how to verify condition of TCS switches in ignition spark control system(s).
127. Knowledge of how to verify condition of sensors in ignition spark control system(s).
128. Knowledge of how to evaluate air injection (AIS) system.
129. Knowledge of how to verify condition of thermal vacuum switches in exhaust gas

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3 Advanced Technicians in Test Only Stations	
	recirculation (EGR) system. 130. Knowledge of how to evaluate catalytic converter system. 131. Knowledge of fuel evaporative (EVAP) system components. 132. Knowledge of how to verify condition of hoses in fuel induction system. 133. Knowledge of how to verify condition of sensors. 134. Knowledge of how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system. 135. Knowledge of how to evaluate exhaust gas recirculation (EGR) system. 136. Knowledge of how to evaluate fuel evaporative (EVAP) system. 137. Knowledge of how to verify condition of wiring. 138. Knowledge of how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system. 139. Knowledge of how to verify condition of wiring in fuel induction system. 140. Knowledge of exhaust gas recirculation (EGR) system components. 141. Knowledge of how to verify condition of spark delay valves in ignition spark control system(s). 142. Knowledge of how to verify condition of speed switches in exhaust gas recirculation (EGR) system. 143. Knowledge of how to verify condition of electrical components in air injection (AIS) system. 144. Knowledge of how to evaluate positive crankcase ventilation (PCV) system. 145. Knowledge of how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system. 146. Knowledge of how to verify condition of vapor storage canister in fuel evaporative (EVAP) system. 147. Knowledge of how to evaluate sensors, switches, and computers.

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3 Advanced Technicians in Test Only Stations	
	148. Knowledge of how to verify condition of air pump in air injection (AIS) system. 149. Knowledge of how to verify condition of valve(s) in positive crankcase ventilation (PCV) system. 150. Knowledge of how to evaluate thermostatic air cleaner (TAC) system. 151. Knowledge of references used to identify components of the exhaust gas recirculation (EGR) system. 152. Knowledge of how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system. 153. Knowledge of how to verify condition of valve(s) in air injection (AIS) system. 154. Knowledge of how to verify condition of vacuum signal lines in air injection (AIS) system. 155. Knowledge of how to verify type of fuel tank cap in fuel evaporative (EVAP) system. 156. Knowledge of how to verify condition of solenoids in fuel evaporative (EVAP) system. 157. Knowledge of external damage to catalytic converter system. 158. Knowledge of how to verify condition of thermal vacuum switches in ignition spark control system(s). 159. Knowledge of how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system. 160. Knowledge of how to verify condition of hoses in fuel evaporative (EVAP) system. 161. Knowledge of references used to identify components of the fuel evaporative (EVAP) system. 162. Knowledge of references used to identify components of the air injection (AIS) system. 163. Knowledge of references used to identify components of the thermostatic air cleaner (TAC) system. 164. Knowledge of how to verify condition of heat delivery pipes in thermostatic air cleaner

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3
Advanced Technicians in Test Only Stations

(TAC) system.
165. Knowledge of thermostatic air cleaner (TAC) system components.
166. Knowledge of how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system.
167. Knowledge of how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system.
168. Knowledge of how to verify condition of heat stoves in thermostatic air cleaner (TAC) system.
169. Knowledge of how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.
170. Knowledge of how to verify condition of required hoses in positive crankcase ventilation (PCV) system.
171. Knowledge of how to verify routing of distribution hoses in air injection (AIS) system.
172. Knowledge of references used to identify components of the positive crankcase ventilation (PCV) system.

VII. Functional Test(s) (9%)

This areas assess the candidate's ability to use correct procedures for testing the functional operation of emissions-related components.

TASKS

69. Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.
70. Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.
71. Evaluate vehicle's malfunction indicator light (MIL) by performing functional test.
72. Perform and evaluate LPFET test on vehicle.
73. Perform fuel cap functional test.
74. Perform OBDII test as prompted by the analyzer to determine vehicle readiness

ASSOCIATED KNOWLEDGE

173. Knowledge of how to verify function of exhaust gas recirculation (EGR) system.
174. Knowledge of how to perform LPFET test.
175. Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.
176. Knowledge of vehicles that require LPFET test.
177. Knowledge of the purpose for performing LPFET test.
178. Knowledge of how to verify vehicle ignition timing.
179. Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.

Table 9. Exam Outline for Advanced Technicians in Test Only Stations

ATO Exam Outline No. 3 Advanced Technicians in Test Only Stations	
indicator and code status. 75. Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.	180. Knowledge of vehicles that are exempt from ignition timing functional test. 181. Knowledge of how to perform fuel cap functional test. 182. Knowledge of procedures for performing OBD II functional test. 183. Knowledge of reasons for performing ignition timing functional test. 184. Knowledge of how to verify function of malfunction indicator light (MIL). 185. Knowledge of reasons for performing OBD II functional test. 186. Knowledge of reasons for performing exhaust gas recirculation (EGR) functional test. 187. Knowledge of reasons for performing fuel cap functional test. 188. Knowledge of vehicles that require fuel cap functional test. 189. Knowledge of reasons for performing fillpipe restrictor functional test. 190. Knowledge of how to verify function of fillpipe restrictors.

Table 10. Exam Outline for Basic Technicians in Test Only Stations

BTO Exam Outline No. 4
Basic Technicians in Test Only Stations

I. Consumer Consultation (16%)

This area assess the candidate's ability to consult with the consumer about authorization to perform smog check inspections according to state law and regulations.

TASKS

1. Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.
2. Inform the consumer about the smog check results by explaining the vehicle inspection report (VIR).
3. Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.
4. Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.
5. Prepare work order for consumer to document smog check inspection to be performed.
6. Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.
7. Consult with customer regarding regulations on catalyst replacement.
8. Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.
9. Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.
10. Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.
11. Provide consumer with list of stations authorized to diagnose and repair vehicles.
12. Inform consumer of the option and scope of a pretest smog check inspection to

ASSOCIATED KNOWLEDGE

1. Knowledge of reasons for obtaining consumer authorization before performing smog check inspection.
2. Knowledge of information to provide on work orders for smog check inspection.
3. Knowledge of type of information provided in vehicle inspection report (VIR).
4. Knowledge of types of procedure(s) performed during smog check inspection.
5. Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
6. Knowledge of how to prepare work orders for smog check inspection.
7. Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
8. Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.
9. Knowledge of laws and regulations regarding performing minor repairs on vehicles.
10. Knowledge of laws and regulations for informing consumers about catalytic replacement.
11. Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
12. Knowledge of reasons for performing minor repairs on vehicles.
13. Knowledge of how to determine if vehicle needs minor repairs before performing smog check inspection.
14. Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).
15. Knowledge of reasons for performing smog

Table 10. Exam Outline for Basic Technicians in Test Only Stations

BTO Exam Outline No. 4
Basic Technicians in Test Only Stations

determine if consumer wants an inspection performed.	check inspection on vehicles. 16. Knowledge of reasons for referring consumers to referee stations (e.g., engine change, SPCNS). 17. Knowledge of laws and regulations requiring vehicles to be tested at a test only station. 18. Knowledge of reasons for providing consumer with vehicle inspection report (VIR). 19. Knowledge of how to determine if a vehicle requires smog check inspection. 20. Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles. 21. Knowledge of how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution). 22. Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection. 23. Knowledge of how to inform consumer about the option and scope of a pretest smog check inspection. 24. Knowledge of procedures used to determine if a consumer wants pretest smog check inspection. 25. Knowledge of how to inform consumers of contact information for stations that diagnose and repair vehicles. 26. Knowledge of how to obtain information from consumers regarding type of smog check inspection needed.

II. Vehicle Identification (9%)

This area assess the candidate's ability to identify the vehicle to be tested.

TASKS	ASSOCIATED KNOWLEDGE
20. Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements. 21. Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license	43. Knowledge of how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label. 44. Knowledge of information used to determine when vehicle does not conform to emissions

Table 10. Exam Outline for Basic Technicians in Test Only Stations

BTO Exam Outline No. 4
Basic Technicians in Test Only Stations

number) to determine accuracy of information prior to performing smog check inspection.
22. Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).
23. Evaluate documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).

certifications (i.e., Gray Market).
45. Knowledge of how to verify vehicle information prior to performing smog check inspection.
46. Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).
47. Knowledge of how to determine type of vehicle certification (e.g., California, Federal, BAR label).
48. Knowledge of how to verify accuracy of consumer's DMV renewal notice.

III. Safety Precautions (12%)

This areas assess the candidate's ability to identify and determine whether the vehicle presented for testing has any conditions that would render emissions testing problematic and/or unsafe.

TASKS

24. Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) prior to performing smog check inspection.
25. Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.
26. Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.
27. Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing smog check inspection.
28. Maintain safety of testing area by keeping area clean.
29. Consult with consumer for authorization to perform minor repair(s) (e.g., loose hose clamp) on vehicle to ensure safety during smog check inspection.
30. Perform minor repair(s) (e.g., tighten loose hose clamp) on vehicle if needed during safety inspection.

ASSOCIATED KNOWLEDGE

49. Knowledge of how to identify unsafe vehicle conditions.
50. Knowledge of how to operate equipment during smog check inspection.
51. Knowledge of how to ensure technician safety while operating equipment during smog check inspection.
52. Knowledge of laws and regulations about stations performing repairs on vehicles to ensure safe test conditions.
53. Knowledge of information to provide consumers about unsafe vehicle condition(s).
54. Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.
55. Knowledge of how to inspect the condition of a vehicle.
56. Knowledge of reasons for verifying vehicle safety prior to performing smog check inspection.
57. Knowledge of how to determine when smog check inspection needs to be aborted.
58. Knowledge of equipment used during smog check inspection that could harm consumer,

Table 10. Exam Outline for Basic Technicians in Test Only Stations

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Basic Technicians in Test Only Stations

staff, and technician.
59. Knowledge of how to maintain consumer and staff safety while conducting smog check inspection.
60. Knowledge of reasons for performing minor repairs to a vehicle during safety check.
61. Knowledge of references used to inform technician of equipment operation.
62. Knowledge of the requirements for maintaining a clean smog check test area.

IV. Calibration of Analyzer and Devices (6%)

This areas assess the candidate's ability to interpret and respond to analyzer prompts, maintain or troubleshoot analyzer system malfunctions and perform required analyzer service procedures.

TASKS

31. Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.
32. Perform visual inspection of analyzer components (i.e., RPM pickup) to ensure accurate functioning during smog check inspection.
33. Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.
34. Perform troubleshooting procedures on analyzer sample system to restore function of system.
35. Perform troubleshooting procedures on LPFET analyzer to restore function to system.
36. Perform troubleshooting procedures on fuel cap test devices to restore function of system.

ASSOCIATED KNOWLEDGE

63. Knowledge of procedures used to calibrate LPFET analyzer.
64. Knowledge of LPFET analyzer upload.
65. Knowledge of analyzer components(s) (i.e., RPM pickup, exhaust probe) used during smog check inspection.
66. Knowledge of how to inspect analyzer maintenance components for possible replacement.
67. Knowledge of how to verify function of analyzer component(s) (i.e., RPM, probe pickup).
68. Knowledge of how to verify function of fuel cap test device(s).
69. Knowledge of how to calibrate fuel cap test device(s).
70. Knowledge of how to troubleshoot analyzer system.
71. Knowledge of how to troubleshoot on-line phone connection.
72. Knowledge of references used by technician to troubleshoot analyzer system and components.
73. Knowledge of how to replace analyzer maintenance components.
74. Knowledge of how to troubleshoot fuel cap integrity test device(s).
75. Knowledge of references used by technician

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Basic Technicians in Test Only Stations

to troubleshoot fuel cap test devices.

V. Emissions Test(s) Procedures (15%)

This areas assess the candidate's ability to use correct procedures for testing the functional operations of emissions-related components.

TASKS

39. Remove analyzer devices from vehicle following emissions test as prompted by analyzer.
40. Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.
41. Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.
42. Validate technician authorization to perform emissions test by entering access code into analyzer.
43. Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.
44. Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.
45. Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.
46. Prepare vehicle for LPFET test.
47. Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.
48. Perform LPFET test as required by vehicle type.
49. Secure vehicle during emissions test (e.g., two speed idle) by setting the emergency brake.
50. Perform pretest smog check inspection on vehicle if authorized by consumer.

ASSOCIATED KNOWLEDGE

80. Knowledge of procedures used to perform LPFET test.
81. Knowledge of how to prepare vehicle for performing an emissions test.
82. Knowledge of vehicle information used to prepare for an emissions test.
83. Knowledge of procedures used following the completion of emission(s) test.
84. Knowledge of how to secure vehicle while performing a two-speed idle test.
85. Knowledge of how to enter vehicle information.
86. Knowledge of how to perform two-speed idle (TSI) test.
87. Knowledge of reasons for selecting vehicle gear as prompted by analyzer.
88. Knowledge of reasons for warming vehicle engine prior to performing an emissions test.
89. Knowledge of how to verify weight classification of vehicle.
90. Knowledge of device(s) used to detect engine rpm.
91. Knowledge of how to perform pretest smog check inspection.
92. Knowledge of how to validate technician access to EIS to perform smog check inspection.
93. Knowledge of reasons for verifying weight classification of vehicle.
94. Knowledge of reasons for performing pretest smog check inspection.
95. Knowledge of device(s) used to sample vehicle exhaust system.

VI. Visual Inspection (32%)

This areas assess the candidate's ability to perform a comprehensive visual inspection by identifying

Table 10. Exam Outline for Basic Technicians in Test Only Stations

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Basic Technicians in Test Only Stations

the condition of required emission-related components.

TASKS

56. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.
57. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.
58. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.
59. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related components on vehicle.
60. Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.
61. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.
62. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.
63. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.
64. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.
65. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.
66. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on vehicle.

ASSOCIATED KNOWLEDGE

105. Knowledge of references (e.g., CARB, Appendix K) used to identify approved replacement emission components.
106. Knowledge of references used to identify required emission controlled components of a vehicle.
107. Knowledge of how to identify liquid fuel leaks.
108. Knowledge of how to verify vehicle emission components.
109. Knowledge of how to evaluate fuel induction system.
110. Knowledge of reasons for identifying liquid fuel leaks.
111. Knowledge of how to verify condition of fuel injection system.
112. Knowledge of fuel induction system components.
113. Knowledge of procedures used to perform visible smoke test.
114. Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.
115. Knowledge of references used to identify other vehicle emissions related components that are permitted in vehicle.
116. Knowledge of sensors, switches, and computers in vehicle.
117. Knowledge of how to verify condition of carburetor in fuel induction system.
118. Knowledge of ignition spark control system(s).
119. Knowledge of how to identify installation of other vehicle emission related components.
120. Knowledge of air injection (AIS) system components.
121. Knowledge of positive crankcase ventilation (PCV) system components.
122. Knowledge of references used to identify sensors, switches, and computers of

Table 10. Exam Outline for Basic Technicians in Test Only Stations

BTO Exam Outline No. 4
Basic Technicians in Test Only Stations

67. Perform visual smoke test.
68. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.

vehicle.
123. Knowledge of references used to identify components of the fuel induction system.
124. Knowledge of references used to identify components of the ignition spark control system(s).
125. Knowledge of how to evaluate ignition spark control system(s).
126. Knowledge of how to verify condition of TCS switches in ignition spark control system(s).
127. Knowledge of how to verify condition of sensors in ignition spark control system(s).
128. Knowledge of how to evaluate air injection (AIS) system.
129. Knowledge of how to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.
130. Knowledge of how to evaluate catalytic converter system.
131. Knowledge of fuel evaporative (EVAP) system components.
132. Knowledge of how to verify condition of hoses in fuel induction system.
133. Knowledge of how to verify condition of sensors.
134. Knowledge of how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.
135. Knowledge of how to evaluate exhaust gas recirculation (EGR) system.
136. Knowledge of how to evaluate fuel evaporative (EVAP) system.
137. Knowledge of how to verify condition of wiring.
138. Knowledge of how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.
139. Knowledge of how to verify condition of wiring in fuel induction system.
140. Knowledge of exhaust gas recirculation (EGR) system components.
141. Knowledge of how to verify condition of spark delay valves in ignition spark control system(s).

Table 10. Exam Outline for Basic Technicians in Test Only Stations

BTO Exam Outline No. 4 Basic Technicians in Test Only Stations	
	142. Knowledge of how to verify condition of speed switches in exhaust gas recirculation (EGR) system. 143. Knowledge of how to verify condition of electrical components in air injection (AIS) system. 144. Knowledge of how to evaluate positive crankcase ventilation (PCV) system. 145. Knowledge of how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system. 146. Knowledge of how to verify condition of vapor storage canister in fuel evaporative (EVAP) system. 147. Knowledge of how to evaluate sensors, switches, and computers. 148. Knowledge of how to verify condition of air pump in air injection (AIS) system. 149. Knowledge of how to verify condition of valve(s) in positive crankcase ventilation (PCV) system. 150. Knowledge of how to evaluate thermostatic air cleaner (TAC) system. 151. Knowledge of references used to identify components of the exhaust gas recirculation (EGR) system. 152. Knowledge of how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system. 153. Knowledge of how to verify condition of valve(s) in air injection (AIS) system. 154. Knowledge of how to verify condition of vacuum signal lines in air injection (AIS) system. 155. Knowledge of how to verify type of fuel tank cap in fuel evaporative (EVAP) system. 156. Knowledge of how to verify condition of solenoids in fuel evaporative (EVAP) system. 157. Knowledge of external damage to catalytic converter system. 158. Knowledge of how to verify condition of thermal vacuum switches in ignition spark control system(s).

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159. Knowledge of how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system.
160. Knowledge of how to verify condition of hoses in fuel evaporative (EVAP) system.
161. Knowledge of references used to identify components of the fuel evaporative (EVAP) system.
162. Knowledge of references used to identify components of the air injection (AIS) system.
163. Knowledge of references used to identify components of the thermostatic air cleaner (TAC) system.
164. Knowledge of how to verify condition of heat delivery pipes in thermostatic air cleaner (TAC) system.
165. Knowledge of thermostatic air cleaner (TAC) system components.
166. Knowledge of how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system.
167. Knowledge of how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system.
168. Knowledge of how to verify condition of heat stoves in thermostatic air cleaner (TAC) system.
169. Knowledge of how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.
170. Knowledge of how to verify condition of required hoses in positive crankcase ventilation (PCV) system.
171. Knowledge of how to verify routing of distribution hoses in air injection (AIS) system.
172. Knowledge of references used to identify components of the positive crankcase ventilation (PCV) system.

VII. Functional Test(s) (10%)

This areas assess the candidate's ability to use correct procedures for testing the functional operation

Table 10. Exam Outline for Basic Technicians in Test Only Stations

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of emissions-related components.

TASKS

69. Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.
70. Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.
71. Evaluate vehicle's malfunction indicator light (MIL) by performing functional test.
72. Perform and evaluate LPFET test on vehicle.
73. Perform fuel cap functional test.
74. Perform OBDII test as prompted by the analyzer to determine vehicle readiness indicator and code status.
75. Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.

ASSOCIATED KNOWLEDGE

173. Knowledge of how to verify function of exhaust gas recirculation (EGR) system.
174. Knowledge of how to perform LPFET test.
175. Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.
176. Knowledge of vehicles that require LPFET test.
177. Knowledge of the purpose for performing LPFET test.
178. Knowledge of how to verify vehicle ignition timing.
179. Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.
180. Knowledge of vehicles that are exempt from ignition timing functional test.
181. Knowledge of how to perform fuel cap functional test.
182. Knowledge of procedures for performing OBD II functional test.
183. Knowledge of reasons for performing ignition timing functional test.
184. Knowledge of how to verify function of malfunction indicator light (MIL).
185. Knowledge of reasons for performing OBD II functional test.
186. Knowledge of reasons for performing exhaust gas recirculation (EGR) functional test.
187. Knowledge of reasons for performing fuel cap functional test.
188. Knowledge of vehicles that require fuel cap functional test.
189. Knowledge of reasons for performing fillpipe restrictor functional test.
190. Knowledge of how to verify function of fillpipe restrictors.

Attachment 1. Tasks

Numbering of task statements in this list corresponds directly to numbering in the 2006 study. This is different than the numbering that appears in the 2009 exam outlines. Wording that has is in a ~~strikeout format~~ was deleted by SMEs in the focus group workshops. Wording that is red and underlined represents new text or information. All edits are shown.

I. Consumer Consultation

1. Consult with consumer to determine type of smog check inspection (e.g., initial registration, renew registration, change of ownership) to be performed on vehicle.
2. Evaluate vehicle information to determine if vehicle requires a smog check prior to performing smog check inspection.
3. Inform consumer about the purpose(s) for performing a smog check inspection to educate consumer about smog check program.
4. Prepare work order for consumer to document smog check inspection to be performed.
5. Obtain consumer authorization prior to performing smog check inspection to verify that the consumer agrees to the service(s) to be performed.
6. Inform consumer of the option and scope of a pretest smog check inspection to determine if consumer wants an inspection performed.
7. Inform the consumer ~~of vehicle~~ about the smog check results by explaining the vehicle inspection report (VIR) ~~to the consumer~~.
8. Consult with consumer regarding minor repairs that should be performed on the vehicle prior to completing smog check inspection.
9. Obtain consumer authorization prior to performing minor repairs on vehicle during smog check inspection to verify that the consumer agrees to the repairs.
10. Consult with consumer to determine if vehicle requires testing at a test only station prior to performing smog check inspection.
11. Consult with consumer regarding diagnostic testing if vehicle fails smog check inspection.
12. Obtain consumer authorization to conduct diagnostic testing of vehicle when vehicle fails smog check inspection.
13. Provide consumer with a vehicle repair cost estimate documenting recommended vehicle repairs following diagnostic testing procedures.
14. Consult with consumer to determine if vehicle repairs ~~are~~ may be covered under warranty prior to performing repairs.

15 Obtain consumer authorization to perform repairs on vehicle as determined by diagnostic testing.

16. Consult with consumer regarding the retest procedures of a vehicle following repairs made to vehicle.

17. Provide consumer with list of stations authorized to diagnose and repair vehicles.

New Consult with customer regarding Low Pressure Fuel Evaporation Test (LPFET) test.

New Consult with customer regarding regulations on catalyst replacement.

II. Vehicle Identification

18. Verify consumer's DMV renewal notice and vehicle information (e.g., VIN label, license number) to determine accuracy of information prior to performing smog check inspection.

19. Evaluate vehicle emission label or the application manual to determine vehicle emission control requirements.

20. Evaluate ~~vehicle~~ documentation to determine if vehicle is required to be tested at a specific type of station (e.g., referee, gold shield).

21. Evaluate vehicle emission label to determine type of vehicle certification (e.g., California, Federal, BAR label).

III. Safety Precautions

22. Perform visual safety inspection on vehicle by checking condition of vehicle components (e.g., fluid leaks) ~~to ensure safety~~ prior to performing smog check inspection.

23. Consult with consumer ~~to determine if~~ for authorization to perform minor repair(s) (e.g., loose hose clamp) ~~need to be performed~~ on vehicle to ensure safety during smog check inspection.

24. Perform minor repair(s) (e.g., tighten loose hose clamp) on vehicle if needed during safety inspection.

25. Maintain safety of testing area by keeping area clean.

26. Maintain safety of testing area by not permitting consumer or unauthorized staff to enter the testing area while performing smog check inspection.

27. Maintain technician safety while servicing vehicle (e.g., inspection, diagnosis, repair) by following recommended procedures of vehicle and equipment manufacturers.

28. Evaluate vehicle throughout smog check inspection process to determine if smog check inspection should be aborted to maintain safety.

	IV. Calibration of Analyzer and Devices
29.	Perform calibration of emissions testing systems to ensure accurate functioning of systems during smog check inspection.
30.	Perform visual inspection of analyzer components (i.e., RPM~~, probe~~ pickup) to ensure accurate functioning during smog check inspection.
31.	Inspect analyzer devices to ensure accurate functioning of devices during smog check inspection or replace if needed.
32.	Perform troubleshooting procedures on analyzer sample system to restore function of system.
33.	Perform troubleshooting procedures on fuel cap test devices to restore function of system.
34.	Inspect dynamometer to ensure safe operation prior to performing calibration.
35.	Perform troubleshooting procedures on dynamometer to restore function of system.
New	Perform troubleshooting procedures on LPFET analyzer to restore function to system.
	V. Emissions Test(s) Procedures
36.	Prepare vehicle for emissions test by warming engine to operating temperature prior to performing emissions test.
37.	Prepare vehicle for emissions test by selecting vehicle gear as prompted by the analyzer.
38.	Secure vehicle during emissions test (e.g., two speed idle) by setting the emergency brake.
39.	Validate technician authorization to perform emissions test by entering access code into analyzer.
40.	Prepare for emissions test(s) by entering vehicle information (e.g., weight, emission controls) as prompted by analyzer.
41.	Prepare for emissions test by inserting probe(s) into vehicle exhaust system as prompted by analyzer.
42.	Prepare for emissions test by attaching RPM pickup to vehicle as prompted by analyzer.
43.	Perform pretest smog check inspection on vehicle if authorized by consumer.
44.	Perform two speed idle (TSI) test as prompted by analyzer to evaluate vehicle emissions.
45.	Remove analyzer devices from vehicle following emissions test as prompted by analyzer.

46. Prepare vehicle for emissions test by operating cooling fan to prevent overheating of vehicle during ASM emissions test as prompted by analyzer.

47. Evaluate vehicle (e.g., front wheel drive, rear wheel drive) to determine placement of vehicle on dynamometer prior to performing emissions test.

48. Prepare vehicle for emissions test by securing vehicle onto dynamometer (e.g., blocks, straps).

49. Weigh vehicle prior to performing emissions test to set load of dynamometer.

50. Perform acceleration simulation mode (ASM) test as prompted by analyzer to evaluate vehicle emissions.

New Prepare vehicle for LPFET test.

New Perform LPFET test as required by vehicle type.

VI. Visual Inspection

51. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of positive crankcase ventilation (PCV) system on vehicle.

52. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of approved catalytic converter system on vehicle.

53. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of exhaust gas recirculation (EGR) system on vehicle.

54. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of thermostatic air cleaner (TAC) system on vehicle.

55. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of air injection (AIS) system on vehicle.

56. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of fuel evaporative (EVAP) system on vehicle.

57. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify ignition spark control system(s) on vehicle.

58. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify fuel induction system on vehicle.

59. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to detect the presence of liquid fuel leaks.

60. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify the installation of sensors, switches, and computers on vehicle.

61. Perform comprehensive visual inspection of vehicle as prompted by the analyzer to verify installation of other emission related components on vehicle.

62. Verify vehicle emissions components to determine whether components are original to the vehicle or permitted substitutes for the vehicle.

New Perform visual smoke test.

VII. Functional Test(s)

63. Evaluate ~~function of~~ vehicle's malfunction indicator light (MIL) by performing functional test.

64. Perform OBDII test as prompted by the analyzer to determine vehicle readiness indicator and code status.

65. Evaluate ignition timing of the vehicle as prompted by the analyzer by following manufacturer procedures.

66. Evaluate function of the exhaust gas recirculation (EGR) system as prompted by the analyzer by following manufacturer procedures.

67. Evaluate function of fillpipe restrictor(s) on vehicle as prompted by the analyzer.

68. Perform fuel cap functional test ~~to verify functioning of fuel cap~~.

New Perform and evaluate LPFET test on vehicle.

VIII. Diagnosis

69. Evaluate vehicle inspection report (VIR) to identify areas that indicate vehicle failure.

70. Perform baseline test on vehicle to verify failure identified on vehicle inspection report (VIR) prior to performing diagnostic testing.

71. Evaluate vehicle ~~system(s)~~ to determine if failure was due to physical condition or tampering with ~~of~~ system(s).

72. Evaluate emissions results (e.g., excessive HC, excessive CO) to identify ~~system(s) in vehicle~~ vehicle system(s) that need diagnostic testing.

73. Perform diagnostic testing on vehicle system(s) that indicate failure during smog check inspection to identify areas of repair.

74. Evaluate diagnostic readings to determine if a system failure in a vehicle may be causing other systems to fail.

IX. Performing and Verifying Repairs	
75.	Evaluate diagnostic testing results to determine if components of vehicle system(s) need to be cleaned, repaired, or replaced.
76.	Clean out components of vehicle system(s) as indicated by vehicle diagnosis.
77.	Repair components of vehicle system(s) as indicated by vehicle diagnosis.
78.	Replace components of vehicle system(s) as indicated by vehicle diagnosis.
79.	Perform after repair smog check inspection to determine if repair of vehicle is successful.

Attachment 2. Knowledge

Numbering of knowledge statements in this list corresponds directly to numbering in the 2006 study. This is different than the numbering that appears in the 2009 exam outlines. Wording that has is in a ~~strikeout format~~ was deleted by SMEs in the focus group workshops. Wording that is red and underlined represents new text or information. All edits are shown.

I. Consumer Consultation

1. Knowledge of types of procedure(s) performed during smog check inspection.
2. Knowledge of ~~purposes~~ reasons for performing smog check inspection on vehicles.
3. Knowledge of laws and regulations requiring vehicles to receive a smog check inspection.
4. Knowledge of ~~methods used~~ how to obtain information from consumers regarding type of smog check inspection needed.
5. Knowledge of ~~methods used~~ how to determine if a vehicle requires smog check inspection.
6. Knowledge of laws and regulations requiring vehicles to be tested at a test only station.
7. Knowledge of ~~procedures used~~ how to inform consumers about the purpose of performing smog check inspection (e.g., emission control, air pollution).
8. Knowledge of laws and regulations regarding educating consumers about repair cost waivers.
9. Knowledge of laws and regulations regarding educating consumers about economic hardship extensions when vehicle fails smog check inspection.
10. Knowledge of ~~purposes~~ reasons for referring consumers to referee stations (e.g., engine change, SPCNS).
11. Knowledge of ~~methods used~~ how to prepare work orders for smog check inspection.
12. Knowledge of information to provide on work orders for smog check inspection.
13. Knowledge of ~~purpose~~ reasons for obtaining consumer authorization before performing smog check inspection.
14. Knowledge of laws and regulations requiring consumer authorization for smog check inspection.
15. Knowledge of ~~methods used~~ how to inform consumer about the option and scope of a pretest smog check inspection.

16. Knowledge of procedures used to determine if a consumer wants pretest smog check inspection.

17. Knowledge of type of information provided in vehicle inspection report (VIR).

18. Knowledge of ~~purpose~~ reasons for providing consumer with vehicle inspection report (VIR).

~~19. Knowledge of types of repairs that can be considered minor repairs.~~

20. Knowledge of ~~procedures used~~ how to determine if vehicle needs minor repairs before performing smog check inspection.

21. Knowledge of laws and regulations regarding performing minor repairs on vehicles.

22. Knowledge of ~~purposes~~ reasons for performing minor repairs on vehicles.

23. Knowledge of information to provide consumers regarding state assistance programs (e.g., CAP repair assistance and vehicle retirement).

24. Knowledge of laws and regulations requiring consumer authorization for performing minor repairs on vehicles.

~~25. Knowledge of procedures used to determine if consumer understands the vehicle inspection report (VIR).~~

26. Knowledge of information to provide consumers about retesting a vehicle following repairs.

27. Knowledge of ~~methods used~~ how to determine if smog check inspection of a vehicle needs to be performed at Test Only or Gold Shield station.

28. Knowledge of ~~methods used~~ how to determine if vehicle repairs ~~are~~ may be covered under warranty.

29. Knowledge of ~~procedures used~~ how to obtain information from consumer regarding warranty of vehicle.

30. Knowledge of information to provide consumers about components of a vehicle that may need repair in the future.

31. Knowledge of laws and regulations about performing diagnostic testing on vehicles.

32. Knowledge of ~~purposes~~ reasons for performing diagnostic testing on vehicles.

33. Knowledge of laws and regulations requiring consumer authorization for performing diagnostic testing on vehicles.

34. Knowledge of ~~procedures used~~ how to recommend vehicle repairs to consumers.

35. Knowledge of ~~methods used~~ how to develop repair cost estimates for a vehicle.

36. Knowledge of laws and regulations regarding providing consumers with vehicle repair cost estimates.

37. Knowledge of information provided in vehicle repair cost estimates.

38. Knowledge of laws and regulations regarding performing repairs on vehicles.

39. Knowledge of ~~purposes~~ reasons for performing repairs on vehicles.

40. Knowledge of laws and regulations requiring consumer authorization for performing repairs on vehicles.

41. Knowledge of ~~purposes~~ reasons for conducting retest procedures on a vehicle following repairs.

42. Knowledge of procedures used to inform consumers of contact information for stations that diagnose and repair vehicles.

43. Knowledge of laws and regulations for providing contact information for stations that diagnose and repair vehicles.

New Knowledge of laws and regulations for informing consumers about cataytic replacement.

II. Vehicle Identification

44. Knowledge of ~~methods used~~ how to verify accuracy of consumer's DMV renewal notice.

~~45. Knowledge of purposes for reviewing DMV renewal notices.~~

46. Knowledge of ~~procedures used~~ how to verify vehicle information prior to performing smog check inspection.

~~47. Knowledge of information provided in DMV renewal notices.~~

48. Knowledge of ~~methods used~~ how to determine type of vehicle certification (e.g., California, Federal, BAR label).

49. Knowledge of information ~~to provide to consumers~~ used to determine when vehicle does not conform to emissions certifications (i.e., Gray Market).

~~50. Knowledge of methods used to determine if smog check inspection of a vehicle needs to be performed at a specific type of station (e.g., referee, gold shield).~~

51. Knowledge of laws and regulations requiring vehicles to receive smog check inspection at a specific type of station (e.g., referee, gold shield).

52. Knowledge of ~~methods used~~ how to identify a vehicle that is missing an emissions label and/or has an incorrect emissions label.

~~53. Knowledge of references used to identify a vehicle that does not have an emissions label.~~

III. Safety Precautions

54. Knowledge of ~~methods used~~ how to inspect the condition of a vehicle.

55. Knowledge of ~~purposes~~ reasons for verifying vehicle safety prior to performing smog check inspection.

56. Knowledge of ~~procedures used~~ how to identify unsafe vehicle conditions.

57. Knowledge of information to provide consumers about unsafe vehicle condition(s).

58. *moved to end of section IX*

59. Knowledge of procedures used during smog check inspection if vehicle safety standards are not acceptable.

~~60. Knowledge of methods used to inform consumer of minor repairs that need to be made to vehicle.~~

61. Knowledge of ~~purposes~~ reasons for performing minor repairs to a vehicle during safety check.

~~62. Knowledge of procedures used to perform minor repairs to a vehicle.~~

63. Knowledge of laws and regulations about stations performing ~~minor~~ repairs on vehicles to ensure safe test conditions.

64. *moved to end of section IX*

65. Knowledge of ~~procedures used to clean smog check testing area~~ the requirements for maintaining a clean smog test area.

66. Knowledge of ~~procedures used~~ how to maintain consumer and staff safety while conducting smog check inspection.

67. Knowledge of ~~types of~~ equipment used during smog check inspection that could harm consumer, staff, and technician.

68. Knowledge of ~~procedures used~~ how to operate equipment during smog check inspection.

69. Knowledge of ~~methods used~~ how to ensure technician safety while operating equipment during smog check inspection.

70. Knowledge of ~~types of~~ references used to inform technician of equipment operation.

71. Knowledge of ~~methods used~~ how to determine when smog check inspection needs to be aborted.

~~72. Knowledge of vehicle problems leading to smog check inspection being aborted.~~

IV. Calibration of Analyzer and Devices

73. Knowledge of ~~methods used~~ how to verify function of fuel cap test device(s).

74. Knowledge of ~~procedures used~~ how to calibrate fuel cap test device(s).

75. Knowledge of ~~methods used~~ how to verify function of analyzer component(s) (i.e., RPM~~, probe~~ pickup).

76. Knowledge of ~~types of~~ analyzer components(s) (i.e., RPM~~, probe~~ pickup, exhaust probe) used during smog check inspection.

77. Knowledge of ~~procedures used~~ how to inspect analyzer maintenance components for possible replacement.

78. Knowledge of ~~procedures used~~ how to replace analyzer maintenance components.

79. Knowledge of ~~procedures used~~ how to troubleshoot analyzer system.

80. Knowledge of ~~types of~~ references used by technician to troubleshoot analyzer system and components.

81. Knowledge of ~~procedures used~~ how to troubleshoot fuel cap integrity test device(s).

82. Knowledge of ~~types of~~ references used by technician to troubleshoot fuel cap test devices.

83. Knowledge of ~~methods used~~ how to troubleshoot on-line phone connection.

84. Knowledge of ~~methods used~~ how to verify operation of dynamometer.

85. Knowledge of components of a dynamometer.

86. Knowledge of ~~procedures used~~ how to troubleshoot dynamometer.

87. Knowledge of ~~types of~~ references used by technician to troubleshoot dynamometer.

New Knowledge of procedures used to calibrate LPFET analyzer.

New Knowledge of LPFET analyzer upload.

V. Emissions Test(s) Procedures

88. Knowledge of ~~procedures used~~ how to prepare a vehicle for ~~performing~~ an emissions test.

89. Knowledge of ~~purposes~~ reasons for warming vehicle engine prior to performing an emissions test.

90. Knowledge of ~~purposes~~ reasons for selecting vehicle gear as prompted by analyzer.

91. Knowledge of ~~procedures used~~ how to secure vehicle while performing a two-speed idle test.

92. Knowledge of ~~procedures used~~ how to validate technician access to EIS to perform smog check inspection.

93. Knowledge of ~~methods used~~ how to verify weight classification of vehicle.

94. Knowledge of ~~purposes~~ reasons for verifying weight classification of vehicle.

95. Knowledge of ~~procedures used~~ how to enter vehicle information.

96. Knowledge of ~~type of~~ vehicle information used to prepare for an emissions test.

97. Knowledge of device(s) used to sample vehicle exhaust system.

98. Knowledge of device(s) used to detect engine rpm.

99. Knowledge of ~~procedures used~~ how to perform pretest smog check inspection.

100. Knowledge of ~~purposes~~ reasons for performing pretest smog check inspection.

101. Knowledge of ~~procedures used~~ how to perform two-speed idle (TSI) test.

102. Knowledge of procedures used following the completion of emission(s) test.

103. Knowledge of ~~methods used~~ how to prevent vehicle from overheating during an acceleration simulation mode (ASM) test.

104. Knowledge of ~~methods used~~ how to determine placement of vehicle on dynamometer.

105. Knowledge of ~~purposes~~ reasons for assessing vehicle prior to placing on dynamometer.

~~106. Knowledge of procedures used to secure vehicle onto dynamometer~~.

107. Knowledge of ~~purposes~~ reasons for securing vehicle onto dynamometer.

108. Knowledge of ~~types of~~ equipment and procedures used to secure vehicle onto dynamometer.

109. Knowledge of ~~procedures used~~ how to weigh vehicle on dynamometer.

110. Knowledge of ~~purposes~~ reasons for weighing vehicle on dynamometer.

111. Knowledge of ~~procedures used~~ how to perform acceleration simulation mode (ASM) test.

112. Knowledge of ~~procedures used~~ how to keep vehicle speed stabilized during acceleration simulation mode (ASM) test.

New	Knowledge of procedures used to perform LPFET test.
	VI. Visual Inspection
113.	Knowledge of ~~methods used~~ how to evaluate installation of positive crankcase ventilation (PCV) system.
114.	Knowledge of ~~types of components located in the~~ positive crankcase ventilation (PCV) system components.
115.	Knowledge of ~~methods used~~ how to verify condition of valve(s) in positive crankcase ventilation (PCV) system.
116.	Knowledge of ~~methods used~~ how to verify condition of required hoses in positive crankcase ventilation (PCV) system.
117.	Knowledge of ~~types of~~ references used to identify components of the positive crankcase ventilation (PCV) system.
118.	Knowledge of ~~methods used~~ how to evaluate installation of catalytic converter system.
119.	Knowledge ~~of types~~ of how to evaluate external damage ~~caused~~ to catalytic converter system.
120.	Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ exhaust gas recirculation (EGR) system.
121.	Knowledge of ~~types of components located in the~~ exhaust gas recirculation (EGR) system components.
122.	Knowledge of ~~methods used~~ how to verify condition of thermal vacuum switches in exhaust gas recirculation (EGR) system.
123.	Knowledge of ~~methods used~~ how to verify condition of pressure transducers in exhaust gas recirculation (EGR) system.
124.	Knowledge of ~~methods used~~ how to verify condition of speed switches in exhaust gas recirculation (EGR) system.
125.	Knowledge of ~~methods used~~ how to verify condition of computer-operated solenoids in exhaust gas recirculation (EGR) system.
126.	Knowledge of ~~methods used~~ how to verify condition of vacuum regulating valves in exhaust gas recirculation (EGR) system.
127.	Knowledge of ~~methods used~~ how to verify condition of vacuum hoses in exhaust gas recirculation (EGR) system.
128.	Knowledge of ~~types of~~ references used to identify components of the exhaust gas recirculation (EGR) system.

129. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ thermostatic air cleaner (TAC) system.

130. Knowledge of ~~types of components located in the~~ thermostatic air cleaner (TAC) system components.

131. Knowledge of ~~methods used~~ how to verify condition of heat stoves in thermostatic air cleaner (TAC) system.

132. Knowledge of ~~methods used~~ how to verify condition of heat delivery pipes in thermostatic air cleaner (TAC) system.

133. Knowledge of ~~methods used~~ how to verify condition of vacuum hoses in thermostatic air cleaner (TAC) system.

134. Knowledge of ~~methods used~~ how to verify condition of air cleaner components in thermostatic air cleaner (TAC) system.

135. Knowledge of ~~methods used~~ how to verify condition of thermal vacuum switches in thermostatic air cleaner (TAC) system.

136. Knowledge of ~~types of~~ references used to identify components of the thermostatic air cleaner (TAC) system.

137. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ air injection (AIS) system.

138. Knowledge of ~~types of components located in the~~ air injection (AIS) system components.

139. Knowledge of ~~methods used~~ how to verify condition of air pump in air injection (AIS) system.

140. Knowledge of ~~methods used~~ how to verify condition of valve(s) in air injection (AIS) system.

141. Knowledge of ~~methods used~~ how to verify condition of electrical components in air injection (AIS) system.

142. Knowledge of ~~methods used~~ how to verify condition of vacuum signal lines in air injection (AIS) system.

143. Knowledge of ~~methods used~~ how to verify routing of distribution hoses in air injection (AIS) system.

144. Knowledge of ~~types of~~ references used to identify components of the air injection (AIS) system.

145. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ fuel evaporative (EVAP) system.

146. Knowledge of ~~types of components located in the~~ fuel evaporative (EVAP) system components.

147. Knowledge of ~~methods used~~ how to verify condition of vapor storage canister in fuel evaporative (EVAP) system.

148. Knowledge of ~~methods used~~ how to verify condition of hoses in fuel evaporative (EVAP) system.

149. Knowledge of ~~methods used~~ how to verify condition of solenoids in fuel evaporative (EVAP) system.

150. Knowledge of ~~methods used~~ how to verify type of fuel tank cap in fuel evaporative (EVAP) system.

151. Knowledge of ~~methods used~~ how to verify condition of thermal vacuum switches in fuel evaporative (EVAP) system.

152. Knowledge of ~~types of~~ references used to identify components of the fuel evaporative (EVAP) system.

153. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ ignition spark control system(s).

154. Knowledge of ~~types of components located in the~~ ignition spark control system(s) components.

155. Knowledge of ~~methods used~~ how to verify condition of thermal vacuum switches in ignition spark control system(s).

156. Knowledge of ~~methods used~~ how to verify condition of TCS switches in ignition spark control system(s).

157. Knowledge of ~~methods used~~ how to verify condition of sensors in ignition spark control system(s).

158. Knowledge of ~~methods used~~ how to verify condition of spark delay valves in ignition spark control system(s).

159. Knowledge of ~~types of~~ references used to identify components of the ignition spark control system(s).

160. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ fuel induction system.

161. Knowledge of ~~types of components located in the~~ fuel induction system components.

162. Knowledge of ~~methods used~~ how to verify condition of hoses in fuel induction system.

163. Knowledge of ~~methods used~~ how to verify condition of wiring in fuel induction system.

164. Knowledge of ~~methods used~~ how to verify condition of carburetor in fuel induction system.

165. Knowledge of ~~methods used~~ how to verify condition of fuel injection system.

166. Knowledge of ~~types of~~ references used to identify components of the fuel induction system.

167. Knowledge of ~~methods used~~ how to identify liquid fuel leaks.

168. Knowledge of ~~purposes~~ reasons for identifying liquid fuel leaks.

169. Knowledge of ~~methods used~~ how to evaluate ~~installation of~~ sensors, switches, and computers.

170. Knowledge of ~~types of~~ sensors, switches, and computers in vehicle.

171. Knowledge of ~~methods used~~ how to verify condition of sensors.

172. Knowledge of ~~methods used~~ how to verify condition of wiring.

173. Knowledge of ~~types of~~ references used to identify sensors, switches, and computers of vehicle.

174. Knowledge of ~~methods used~~ how to identify ~~installation of~~ other vehicle emission related components.

175. Knowledge of ~~types of~~ references used to identify other vehicle emissions related components that are permitted in vehicle.

176. Knowledge of ~~methods used~~ how to verify vehicle emission components.

~~177. Knowledge of purposes for verifying emission components of a vehicle~~.

178. Knowledge of ~~types of~~ references used to identify required emission controlled components of a vehicle.

179. Knowledge of requirements for vehicles that consist of additional components (e.g., auxiliary fuel tank) other than the specified equipment of the vehicle.

180. Knowledge of ~~types of~~ references (e.g., CARB, Appendix K) used to identify approved ~~substitute~~ replacement emission components.

New Knowledge of procedures used to perform visible smoke test.

VII. Functional Test(s)

181. Knowledge of ~~procedures used~~ how to verify function of malfunction indicator light (MIL).

182. Knowledge of ~~purposes~~ reasons for performing OBD II functional test.

183. Knowledge of procedures for performing OBD II functional test.

184. Knowledge of ~~procedures used~~ how to verify vehicle ignition timing.

185. Knowledge of vehicle ignition timing parameters indicating smog check inspection failure.

186. Knowledge of vehicles that are exempt from ignition timing functional test.

187. Knowledge of ~~purposes~~ reasons for performing ignition timing functional test.

188. Knowledge of vehicles that require exhaust gas recirculation (EGR) functional test.

189. Knowledge of ~~procedures used~~ how to verify function of exhaust gas recirculation (EGR) system.

190. Knowledge of ~~purposes~~ reasons for performing exhaust gas recirculation (EGR) functional test.

191. Knowledge of ~~procedures used~~ how to verify function of fillpipe restrictors.

192. Knowledge of ~~purposes~~ reasons for performing fillpipe restrictor functional test.

193. Knowledge of ~~procedures used~~ how to perform fuel cap functional test.

194. Knowledge of vehicles that require fuel cap functional test.

195. Knowledge of ~~purposes~~ reasons for performing fuel cap functional test.

New Knowledge of vehicles that require LPFET test.

New Knowledge of how to perform LPFET test.

New Knowledge of the reasons for performing LPFET test.

VIII. Diagnosis

~~196. Knowledge of methods used to identify areas of failure on vehicle inspection report (VIR).~~

197. Knowledge of ~~procedures used~~ how to interpret vehicle inspection report (VIR) regarding onboard diagnostic (OBD) systems.

198. Knowledge of information indicated on vehicle inspection report (VIR).

199. Knowledge of ~~procedures used~~ how to interpret vehicle inspection report (VIR) results.

200. Knowledge of ~~types of~~ references used when evaluating vehicle inspection report (VIR).

201. Knowledge of ~~procedures used~~ how to perform a baseline test prior to diagnosing a vehicle.

202. Knowledge of ~~purposes~~ reasons for performing a baseline test prior to diagnosing a vehicle.

203. Knowledge of oxides of nitrogen (NOx) emission levels.

204. Knowledge of carbon dioxide (CO2) emission levels.

205. Knowledge of carbon monoxide (CO) emission levels.

206. Knowledge of oxygen (O2) emission levels.

207. Knowledge of hydrocarbon (HC) emission levels.

208. Knowledge of ~~types of~~ emissions that are considered hazardous.

209. Knowledge of ~~procedures used~~ how to verify condition of vehicle positive crankcase ventilation (PCV) system.

210. Knowledge of ~~procedures used~~ how to verify condition of vehicle catalytic converter system.

211. Knowledge of ~~procedures used~~ how to verify condition of vehicle exhaust gas recirculation (EGR) system.

212. Knowledge of ~~procedures used~~ how to verify condition of vehicle thermostatic air cleaner (TAC) system.

213. Knowledge of ~~procedures used~~ how to verify condition of vehicle air injection (AIS) system.

214. Knowledge of ~~procedures used~~ how to verify condition of vehicle evaporative (EVAP) system.

215. Knowledge of ~~procedures used~~ how to verify condition of vehicle ignition spark control system(s).

216. Knowledge of ~~procedures used~~ how to verify condition of vehicle fuel induction system.

217. Knowledge of ~~procedures used~~ how to verify condition of vehicle sensors, switches, and computers.

218. Knowledge of ~~procedures used~~ how to verify condition of other related emissions components.

219. Knowledge of components of vehicle systems that may have been tampered with.

220. Knowledge of components of vehicle systems that may have been damaged.

221. Knowledge of ~~types of~~ references used to verify vehicle systems condition.

222. Knowledge of ~~methods used~~ how to diagnose positive crankcase ventilation (PCV) system.

223. Knowledge of ~~methods used~~ how to diagnose catalytic converter system.

224. Knowledge of ~~methods used~~ how to diagnose exhaust gas recirculation (EGR) system.

225. Knowledge of ~~methods used~~ how to diagnose thermostatic air cleaner (TAC) system.

226. Knowledge of ~~methods used~~ how to diagnose air injection (AIS) system.

227. Knowledge of ~~methods used~~ how to diagnose evaporative (EVAP) system.

228. Knowledge of ~~methods used~~ how to diagnose ignition spark control system(s).

229. Knowledge of ~~methods used~~ how to diagnose fuel induction system.

230. Knowledge of ~~methods used~~ how to diagnose sensors, switches, and computers.

231. Knowledge of ~~methods used~~ how to diagnose other related emissions components.

232. Knowledge of ~~procedures used~~ how to perform onboard diagnostic testing.

233. Knowledge of ~~types of~~ references used when performing diagnostic testing on a vehicle.

234. Knowledge of ~~information from~~ interpreting diagnostic testing results indicating vehicle system failures impacting other systems.

235. Knowledge of relationships between vehicle systems.

236. Knowledge of ~~procedures used~~ how to interpret diagnostic readings.

237. Knowledge of equipment used to perform diagnostic testing procedures.

New Knowledge of how to verify the condition of engine mechanical systems.

New Knowledge of mechanical components that need repair or replacement.

IX. Performing and Verifying Repairs

238. Knowledge of ~~methods used~~ how to determine type of vehicle repair to be performed.

239. Knowledge of ~~methods used~~ how to determine if components of vehicle need to be cleaned, repaired, or replaced.

240. Knowledge of procedures and equipment used to clean out components of vehicle system(s).

~~241. Knowledge of equipment used to clean out components of vehicle system(s).~~

242. Knowledge of ~~procedures used~~ how to repair vehicle system(s).

243. Knowledge of ~~components of~~ vehicle system~~(s)~~ components that need repair .

244. Knowledge of ~~components of~~ positive crankcase ventilation (PCV) system components that need repair.

245. Knowledge of ~~components of~~ catalytic converter system components that need repair.

246. Knowledge of ~~components of~~ exhaust gas recirculation (EGR) system components that need repair.

247. Knowledge of ~~components of~~ thermostatic air cleaner (TAC) system components that need repair.

248. Knowledge of ~~components of~~ air injection (AIS) system components that need repair.

249. Knowledge of ~~components of~~ evaporative (EVAP) system components that need repair.

250. Knowledge of ~~components of~~ ignition spark control system(s) components that need repair.

251. Knowledge of ~~components of~~ fuel induction system components that need repair.

252. Knowledge of ~~components of~~ sensor~~s~~, switch~~es~~, and computer~~s~~ components that need repair.

253. Knowledge of other related vehicle components that need repair.

254. Knowledge of ~~types of~~ equipment used to repair vehicle system(s).

255. Knowledge of ~~procedures used~~ how to replace components of vehicle systems.

256. Knowledge of ~~components of~~ vehicle system(s) components that need replacement.

257. Knowledge of ~~components of~~ positive crankcase ventilation (PCV) system components that need replacement.

258. Knowledge of ~~components of~~ catalytic converter system components that need replacement.

259. Knowledge of ~~components of~~ exhaust gas recirculation (EGR) system components that need replacement.

260. Knowledge of ~~components of~~ thermostatic air cleaner (TAC) system components that need replacement.

261. Knowledge of ~~components of~~ of air injection (AIS) system components need replacement.

262. Knowledge of ~~components of~~ evaporative (EVAP) system components that need replacement.

263. Knowledge of ~~components of~~ ignition spark control system~~(s)~~ components that need replacement.

264. Knowledge of ~~components of~~ fuel induction system components that need replacement.

265. Knowledge of ~~components of~~ sensor~~s~~, switch~~es~~, and computer~~s~~ components that need replacement.

266. Knowledge of other related vehicle components that need replacement.

267. Knowledge of ~~types of~~ equipment used to replace vehicle system(s).

268. Knowledge of ~~methods used~~ how to verify vehicle systems repairs.

269. Knowledge of ~~procedures used~~ how to perform an “after repair” smog check inspection.

270. Knowledge of purposes for performing an “after repair” smog check inspection.

II. 58 Knowledge of ~~methods used~~ how to differentiate between minor and major vehicle repairs.

II. 64 Knowledge of ~~types of~~ references used to assist technician in performing ~~minor~~ repairs to a vehicle.

Attachment G

Evaluation of Remote Sensing for Improving California's Smog Check Program

Evaluation of Remote Sensing for Improving California's Smog Check Program

FINAL REPORT
Version 15 (final)

Prepared for:

California Air Resources Board
and
California Bureau of Automotive Repair

Prepared by:

Eastern Research Group, Inc.

March 3, 2008

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Evaluation of Remote Sensing for Improving California's Smog Check Program

FINAL REPORT
Version 15 (final)

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Disclaimer

The statements and conclusions in this report are those of the Contractor and not necessarily those of the California Air Resources Board or the Department of Consumers Affairs / Bureau of Automotive Repair. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

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1.0 Executive Summary

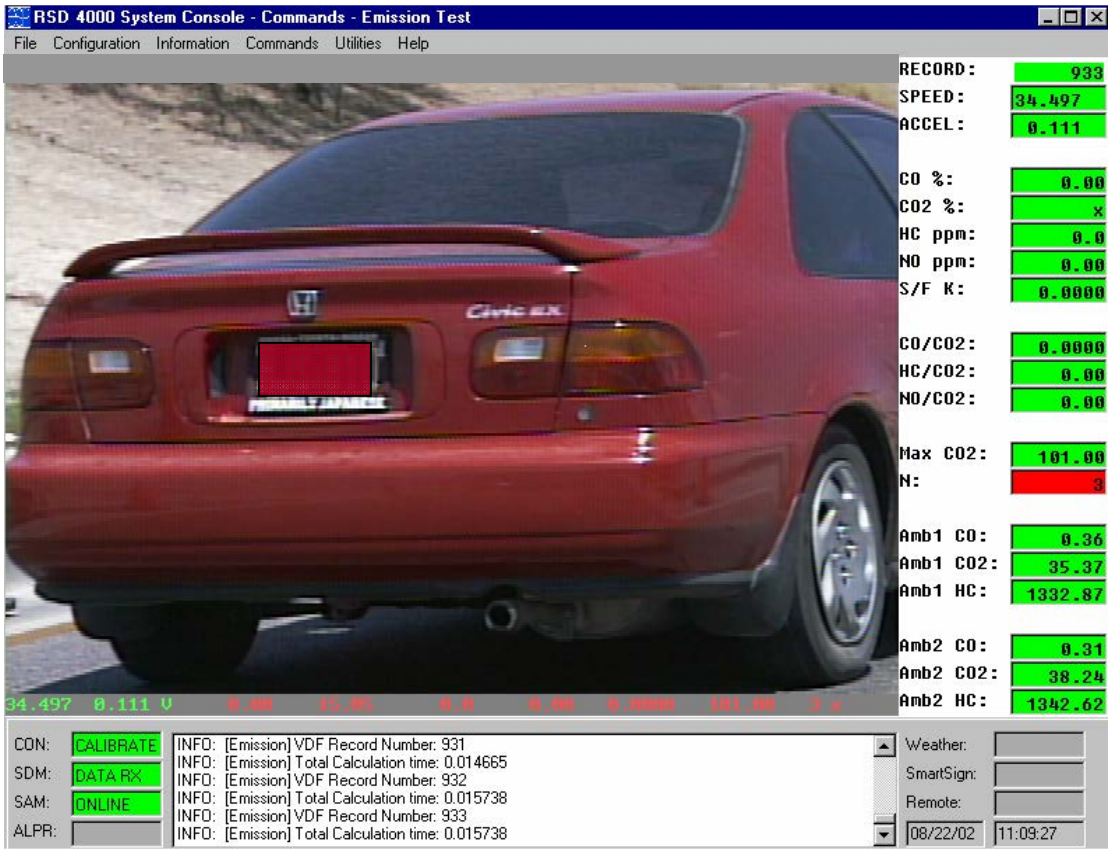
An August 2000 evaluation of California's Smog Check program found the program to be reducing vehicle emissions, but falling short of the reductions set forth in the State Implementation Plan (SIP). To increase the emission reductions of the Smog Check program, the California Air Resources Board (ARB) and the California Bureau of Automotive Repair (BAR) adopted recommendations for improvement based on the evaluation. Most of these recommendations have been implemented. One recommendation was to conduct a pilot program to evaluate whether use of on-road emissions measurement systems, commonly known as Remote Sensing Devices (RSD), could improve the effectiveness of the Smog Check program. This report presents the results of the pilot study.

Remote sensing technology measures pollutants in vehicle exhaust from the side of the roadway. Figure 1-1 shows a vehicle approaching RSD measurement equipment during a test program. Vehicles driving past the measurement site pass through beams of light. The light is partially absorbed by the carbon dioxide (CO_2), carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxide (NO) present in the vehicle's exhaust gases, and is partially blocked and scattered by particulate matter (PM) in the exhaust. Measurement of the effect of the exhaust on the light beams can therefore be correlated to vehicle emission levels at the instant the vehicle passes the measurement site. Less than one second's worth of data is captured. The roadside setup also captures vehicle speed and acceleration to aid in the measurement and analysis of the emission data. A photograph of the license plate is taken to facilitate identification of screened vehicles through Department of Motor Vehicles (DMV) records. Figure 1-2 shows an example of the information collected during an RSD measurement.

The principal objective of the pilot study was to determine whether RSD can be used to cost effectively help in the reduction of vehicle emissions and improve the efficiency of the Inspection and Maintenance (I/M) program, also known as Smog Check. Therefore, the study focused on the effectiveness and cost effectiveness of an RSD program that would supplement California's existing I/M program, not one that would replace it. ARB and BAR staff developed a set of specific questions upon which the evaluation was to be based, and refined them through a public workshop prior to the start of the study. The questions, which are presented and answered below, are focused on the ability of RSD to identify specific individual vehicles for strategies such as "calling-in" for off-cycle inspections or "clean-screening," and also on the potential use of RSD data to help evaluate the benefits of Smog Check and characterize emissions from the on-road fleet.

Figure 1-1. Vehicle Approaching RSD Test Setup

Figure 1-2. Sample RSD Data Record



The study consisted of two primary tasks. The first task was a literature review led by Eastern Research Group (ERG) of existing RSD studies and publications. Remote sensing technology experts reviewed and evaluated data and reports covering 12 previous RSD programs relative to the objectives of the pilot study. Existing research gaps and the need for further studies were identified. The team of experts also gleaned to the extent possible information that would help answer the questions of this study and shape its second task. Overall, it was determined that RSD offers potential for identifying vehicles that would benefit, for example, from off-cycle emission inspections, and could also be useful for fleet characteristic and Smog Check performance evaluations. However, the cost of implementing remote sensing in California was cited as a concern. Another issue that was highlighted is the difficulty of using the brief snapshot of emissions performance that RSD provides to assess the overall emission performance of individual vehicles.

The second study task was to generate a large RSD database to be used as the basis for a thorough review of the potential benefits of currently available RSD technology relative to California's Smog Check program. ARB and BAR staff completed this task by collecting over two-million RSD measurements. The data collection effort began in 2004 and continued into 2005. The measurements were taken primarily in the following areas of California: the South Coast region, San Diego, San Francisco, San Joaquin Valley, and Sacramento. In all, valid, registration matched data were obtained for approximately 420,000 vehicles. Approximately 1,000 of the vehicles were randomly selected to receive a roadside Smog Check test immediately following the RSD reading.

ERG used the field data along with California's Smog Check database, known as the Vehicle Information Database (VID), to develop models that directly answer the study questions. The models analyzed the benefits and costs of targeting vehicles for the strategies identified in the study questions based on RSD measurements alone, RSD measurements used in combination with VID data and, for purposes of further comparison, the use of VID data by itself.

The primary focus in designing the analysis was to determine the maximum statewide emission reductions realistically achievable through a large-scale RSD program. Such a program would field about 50 remote sensing devices to collect approximately 50 million valid remote sensing records per year over the five largest air quality districts in California. One of the findings of the study is that conditions restricting the location of remote sensing devices on various roads and freeway on-ramps practically limits the portion of the California fleet for which RSD measurements can be obtained to about 50%.

The percentage of on-road vehicles that can be targeted for special action is further limited in two ways. First, only the portion of the screened fleet for which the RSD measurement was taken while the vehicle was operating with moderate load on the engine can be considered for targeting. RSD readings taken while a vehicle is decelerating or rapidly accelerating are not useful for predicting Smog Check station results. Therefore, engine loading was determined through the calculation of Vehicle Specific Power (VSP) as each vehicle was driven through the test lane, and only vehicles with a VSP reading falling into an acceptable range were considered for targeting. Second, the study focused only on vehicles subject to California's Smog Check program that were beyond the six-year new vehicle exemption.

Table 1-1 shows the impact of these limitations on the portion of the fleet that can be qualified for targeting through the use of RSD technology. The values are based on the vehicle fleet traveling in the five largest air quality districts in California. For purposes of comparison, small- and medium-scale RSD programs sharing the same basic design as the large-scale program were also modeled. These vehicle population figures are for calendar year 2004.

Table 1-1. Estimated RSD Fleet Coverage

		Program Size		
		Large	**Medium**	**Small**
Statewide Fleet Screened by RSD (within 5 major AQMDs)	Percentage of Fleet	50%	30%	10%
	Number of Vehicles	9,491,440	5,694,864	1,898,288
Screened Vehicles with RSD reading within acceptable power range (VSP) for targeting (within 5 major AQMDs)	Percentage of Fleet	39.74%	22.16%	6.75%
	Number of Vehicles	7,543,705	4,206,161	1,281,030
VSP qualified vehicles subject to I/M	Percentage of Statewide I/M Fleet	30.28%	16.11%	4.67%
	Number of Vehicles	4,053,388	2,157,461	625,831

The data indicate that a maximum of about 30% of the statewide fleet subject to Smog Check can be qualified by RSD for targeting consideration. This percentage excludes vehicles still within the 6-year new vehicle exemption period. The fraction of the fleet that can be targeted using smaller scale programs decreases almost proportionately. Vehicle targeting using VID data can cover a much larger portion of the fleet because it contains vehicle description information for every vehicle subject to California's Smog Check program along with data from all previous inspections. As such, essentially 100% of the I/M fleet that is beyond the six-year new vehicle exemption can be considered for targeting.

A few key assumptions were employed concerning RSD fleet coverage and costs. First, the use of manned RSD units was assumed. Second, the calculations do not try to account for the fact that some motorists may take alternate routes to their destinations in an attempt to avoid passing through an RSD test lane. Third, it was assumed that the RSD siting restrictions during rush hour that were experienced during the data collection portion of this project would be eliminated through coordination with CalTrans. Lastly, no enforcement costs were included (i.e., it was assumed that all motorists receiving notices for testing at a Smog Check station following an RSD screening would respond as intended without having to be further compelled).

ERG developed and applied ranking parameters to select the best candidate vehicles from the fleet for the special I/M strategies under study. The ranking parameters focused (depending on the strategy) on reducing the number of miles driven by vehicles while they are in a condition that would cause them to fail a Smog Check ASM emissions test, or on reducing the expected mass emissions per vehicle as a result of applying the strategy. As discussed in detail in Section 6.4 of the report, program administrators could choose to employ other ranking variables with the understanding that each parameter presents trade-offs with respect to the type of program benefit that will be maximized. When both VID and RSD data are used by the model, RSD data was used to enhance the ranking calculations for the portion of the fleet for which adequate RSD data can be obtained.

Answers to the study questions, summarized below, were based on the three RSD implementation sizes presented above. The percent of vehicles targeted for a particular strategy applies to the portion of the fleet that is both subject to I/M and for which valid, DMV-matched[1] RSD readings were taken that fall within the acceptable VSP range. Questions 1 through 4 focus individually on the benefits and costs of using RSD to call-in high emitting vehicles for off-cycle Smog Check inspections, to exempt clean vehicles from their next scheduled Smog Check, to improve High Emitter Profile (HEP) databases used to direct vehicles from average-performing Smog Check stations to hypothetical high-performing Smog Check stations,[2] and to identify high-emitting vehicles that would be good candidates for early retirement. For Question 5, the benefits of a program that combines the strategies identified in Questions 1 through 4 are evaluated. For Questions 1 through 5, the costs and benefits of supplementing the I/M program

[1] DMV-matched refers to the successful matching of a license plate observed during an RSD measurement with a license plate in the Department of Motor Vehicles' vehicle registration database.

[2] As a concept, "high-performing" stations would perform more-accurate I/M inspections and therefore would be able to provide greater emissions reductions than "average-performing" stations. However, in the analysis we did not attempt to determine which stations or which types of stations (Test Only, Test-and-Repair, Gold Shield, etc.) were average- or high-performing. Instead, based on station-performance information from BAR, we assumed that hypothetical high-performing stations would have fail rates that were 20% higher and after-repair emissions levels that were 20% lower than the system-wide average of all stations currently in the I/M system.

with an RSD component were estimated over a 24-month period since that is the current length of one I/M inspection cycle. Questions 6 and 7 address whether RSD data can be used to collectively evaluate the general emission performance and trends of large groups of vehicles (in contrast to using RSD to select individual vehicles for specific emission-related programs).

The benefits are for calendar year 2004, and the analysis takes into account that a substantial portion of the emission reductions that RSD technology may otherwise provide are already being obtained by the Smog Check program. The calculated benefits, therefore, are those above and beyond the emission reductions already realized by the Smog Check program. This is an important point to remember considering that other studies often look at the entire benefit of a program that includes RSD instead of just the incremental gain. Further, the study focused on statewide implementation of RSD technology. The results, therefore, may not necessarily reflect the relative costs and benefits of small-scale local programs designed to meet local goals and objectives.

Overview of Study Questions and Findings

Question 1: Can remote sensing technology be an effective tool to identify high-emitting vehicles between regular inspection cycles (i.e., calling-in), and to document the emission reduction benefits of such a program?

Answer: No, not when a follow-up I/M station inspection is required

The call-in program modeled under the study would notify vehicle owners of the need to bring their vehicles in for off-cycle inspection if high RSD emission levels were measured. Called-in vehicles would still be subject to their next biennial inspection. For such a program, the study found that there was an insufficient agreement between RSD readings and the results from follow-up ASM tests conducted at a later date. The study found that the Smog Check station ASM failure rate for vehicles with high RSD emissions was less than 50 percent. This means that vehicles predicted to fail an ASM test based on RSD readings would actually pass a follow-up ASM test more than half of the time. The factors that affect the agreement between RSD readings and ASM test results are discussed in Section 9.

Table 1-2 summarizes the results of the pilot study for three specific targeting percentages when using RSD to call-in vehicles for off-cycle Smog Check inspections. Estimated failure rates for high emitter call-ins (as identified by RSD) were only 43.5%, 37.2%, and 32.7% (for 5%, 10%, and 15% call-in rates, respectively). To the extent that vehicles that pass the off-cycle inspection are construed to represent errors of commission, the error of

commission rates would be far beyond the 5 percent limit for the Smog Check program as set forth in California's Health and Safety Code. When using the VID to select candidate vehicles to call-in for an inspection, the analysis indicates that only approximately one-third of the vehicles would fail the follow-up ASM test.

Table 1-2. Using RSD to Target Vehicles for "Call-In" Off-Cycle Inspections

Percent of qualified vehicles called-in	Program Size	Large	Medium	Small
5	Number of Called-In Vehicles	202,669	107,873	31,292
	Benefits (tpd HC+NOx)	1.36	0.72	0.21
	Costs ($/2years)	$79,820,101	$31,869,136	$10,483,248
	Cost Effectiveness ($/ton)	$80,283	$60,223	$68,292
10	Number of Called-In Vehicles	405,339	215,746	62,583
	Benefits (tpd HC+NOx)	2.37	1.26	0.37
	Costs ($/2years)	$99,970,992	$42,594,248	$13,594,359
	Cost Effectiveness ($/ton)	$57,802	$46,270	$50,908
15	Number of Called-In Vehicles	608,008	323,619	93,875
	Benefits (tpd HC+NOx)	3.16	1.68	0.49
	Costs ($/2years)	$118,192,851	$52,293,463	$16,407,881
	Cost Effectiveness ($/ton)	$51,289	$42,634	$46,115

Apart from the low predicted follow-up ASM test failure rate for call-in vehicles, the cost of using RSD technology for this purpose was found to be high in comparison to the emission benefits yielded. Cost effectiveness was calculated to be between approximately $42,000 to $80,000 per ton of emissions reduced, depending on the program size and the percent of qualified vehicles targeted. The benefits and costs of using the VID to call-in high emitting vehicles were also considered when answering Question 5, and are discussed in Section 7.1 of the report.

Agreement between the RSD readings and an immediate roadside ASM test was significantly better than agreement between the RSD readings and later Smog Check station ASMs. The data indicate that, when selecting vehicles from an RSD fleet sample for off-cycle call-in using RSD cutpoints that are equivalent to the applicable ASM cutpoints, 40% of the selected vehicles can be expected to fail an immediate follow-up ASM inspection, but only 25% of the selected vehicles would fail an I/M station ASM inspection. This suggests that factors such as test station performance and repair work conducted after the RSD reading but before the follow-up inspection play a role in reducing the Smog Check failure rate of called-in vehicles.

Therefore, notwithstanding consumer acceptance and other practical implementation issues, a program wherein a binding roadside inspection is given immediately following the RSD measurement could yield greater quantifiable emission reductions in possibly a more cost effective manner.

The data also indicate that setting RSD cutpoints substantially higher than the corresponding ASM cutpoints would result in selected vehicles with a higher probability of failing an immediate follow-up ASM inspection. However, such an approach leaves a large fraction of high ASM emitters not selected for a call-in inspection and, therefore still emitting excessively. For example, the data show that if RSD cutpoints are set high enough that 82% of the selected vehicles would fail an immediate roadside ASM, the set of selected vehicles would contain only 38% of the vehicles that would have failed an immediate roadside ASM if all of the RSDed vehicles had been given an immediate roadside ASM.

Question 2: Can remote sensing technology be an effective tool to "clean screen" vehicles and exempt them from the next scheduled Smog Check inspection, thus reducing program costs?

Answer: No. The costs to administer such a program would exceed the benefits.

The primary benefit of a clean screen strategy is to reduce Smog Check program inspection costs by exempting vehicles that are highly likely to pass their next scheduled Smog Check. However, the analysis indicates that RSD data collection to identify clean-screen candidate vehicles would actually cost more to the state in program expenses than motorists would save through fewer inspections, defeating the purpose of the strategy. Table 1-3 shows the magnitude of the net expected cost increases when using RSD to clean-screen 20% (selected solely for demonstration purposes) of targetable vehicles. As a result, using RSD to clean-screen vehicles appears practical only if RSD data are also being collected for other purposes. In the answer to Question 5, the benefits and costs for clean-screening using RSD are evaluated in combination with other targeting strategies.

Table 1-3. Program Costs/Savings when Using RSD for Clean-Screening

Program Size	Large	Medium	Small
Number of Clean Screened Vehicles	810,678	431,492	125,166
Inspection Cost Savings	$25,131,008	$13,376,261	$3,880,149
RSD Data Collection and Administration Costs	$55,034,520	$18,151,810	$5,707,447
Net Additional Program Costs	$29,903,512	$4,775,549	$1,827,298

Using the VID instead for clean screening would not require further data collection and could result in substantial inspection cost savings. As is the case with virtually any clean screen strategy, a small fraction of the exempted vehicles will not be as clean as expected, and would have in fact benefited from the scheduled inspection. The impact on benefits and costs with respect to using the VID for clean screening are discussed as part of the answer for Question 5 below and also in Section 7.3 of the report.

Question 3: Can remote sensing technology be an effective tool to identify vehicles that would be, based on the vehicle emission levels (and overall condition), candidates for early retirement (scrappage)?

Answer: Yes, but not cost effectively.

Emission benefits and costs for scrappage (Table 1-4) were based on a hypothetical early retirement program with varying available funding to purchase and scrap high emitting vehicles over a two-year period. Candidate vehicles were ranked based on the ratio of expected emission benefits to vehicle value. Vehicles with the highest expected emission benefits per dollar of value were targeted first. Although estimated benefits reached as high as 3.52 tons per day of hydrocarbons and oxides of nitrogen for a large scale RSD program, the corresponding cost of more than $70 million results in a cost effectiveness of approximately $27,000 per ton reduced. The cost effectiveness of using smaller scale RSD programs to identify vehicle scrappage candidates is improved, primarily due to decreased RSD data collection costs. However, the cost effectiveness was found to remain above $16,000 per ton. Cost effectiveness was calculated using only estimated vehicle values as opposed to a cost per vehicle that includes participation incentives, and the analysis assumes that 100% of targeted vehicles would "participate" in the scrappage program. Such a program would be less cost effective to the extent the participation rate is actually less than 100% and higher per vehicle purchase offers are necessary to achieve a participation rate that is considered acceptable.

Table 1-4. Using RSD Data to Select Candidates for Early Vehicle Retirement (Scrappage)

Scrappage Funding Level (approximate)	Program Size	Large	Medium	Small
$8M	Number of Scrapped Vehicles	10,524	8,853	6,087
	Average Value ($/vehicle)	$746	$888	$1,246
	Benefits (tpd HC+NOx)	2.25	1.80	1.13
	Total Costs ($/2years)	$62,891,788	$26,077,722	$13,488,200
	Cost Effectiveness ($/ton)	$38,289	$19,880	$16,364
$12M	Number of Scrapped Vehicles	14,121	11,810	8,304
	Average Value ($/vehicle)	$832	$993	$1,421
	Benefits (tpd HC+NOx)	2.92	2.33	1.49
	Total Costs ($/2years)	$66,651,424	$29,836,011	$17,658,033
	Cost Effectiveness ($/ton)	$31,308	$17,520	$16,221
$16M	Number of Scrapped Vehicles	17,388	14,600	10,195
	Average Value ($/vehicle)	$903	$1,080	$1,555
	Benefits (tpd HC+NOx)	3.52	2.81	1.79
	Total Costs ($/2years)	$70,487,724	$33,789,115	$21,686,836
	Cost Effectiveness ($/ton)	$27,468	$16,456	$16,574

Question 4: Can remote sensing technology be used to improve the State's high emitter profile (HEP), used to direct vehicles to test-only stations?

Answer: Yes, but not cost effectively.

To answer this question, a HEP model separate from that currently used to direct vehicles under Smog Check was developed based on data available within the VID, and the incremental benefit of adding RSD data to the model was evaluated. In this study we did not analyze the accuracy of test-only stations specifically. Instead, we evaluated the effectiveness of directing vehicles to the more general category of "high-performing stations."[3] This category may include some stations that are currently designated as test-only stations and may include stations of other types. The results are shown in Table 1-5 for a hypothetical program where 40% of the vehicles are directed to high-performing stations based on the HEP. The analysis indicates that **adding** RSD data to the HEP would slightly increase the percentage of directed vehicles expected to fail an ASM test (by about 3 percent for a large RSD program). However, the resulting increase in emission benefits was found to be minimal (0.21 tons per day, or less). When compared to RSD

[3] High-performing station is a hypothetical category of California I/M inspection stations that would perform more-accurate I/M inspections and therefore would be able to provide greater emissions reductions than average-performing stations. In the analysis we did not attempt to determine which stations or which types of stations (Test Only, Test-and-Repair, Gold Shield, etc.) were average- or high-performing. Instead, based on station-performance information from BAR, this study assumes that the hypothetical high-performing stations have fail rates that are 20% higher and after-repair emissions levels that are 20% lower than those of average-performing stations.

program costs necessary to implement the HEP improvements, the calculated cost effectiveness was extremely high at $137,000 per ton to more than $350,000 per ton depending on program size.

Table 1-5. Using RSD to Improve Directing of Vehicles to High-Performing Stations

Program Size	Large	Medium	Small
Incremental Benefits (tons/day)	0.21	0.11	0.03
Incremental Costs ($/2 years)	$53,339,459	$15,999,105	$3,185,033
Cost Effectiveness ($/Ton HC+NOx)	$356,496	$200,898	$137,874

Question 5: Can a permanent remote sensing technology program be cost-effectively implemented in California, and what would be the most cost-effective design for such a program?

Answer: No, not cost effectively.

The best opportunity for implementing a cost-effective RSD program is to simultaneously use collected data for multiple purposes. However, as indicated in Table 1-6 below, cost effectiveness for the three program sizes considered is still beyond generally accepted cost-effectiveness thresholds, varying from about $17,000 per ton to $28,000 per ton depending on program size. The cost figures include RSD data collection costs, Smog Check testing and certificate costs, program administration expenses, and the cost or savings associated with the impact of each strategy on repairs and number of vehicles inspected. They represent the RSD program costs that would be incurred over a two-year period. RSD data collection and program costs are discussed in more detail in Section 6.5 of the report.

Table 1-6. Costs and Benefits of Using RSD for Multiple Strategies

Program Size	Large	Medium	Small
Targeting Strategy	**Emissions Reductions (tpd HC + NOx)**		
5% Off-Cycle Call-In	1.36	0.72	0.21
40% HEP Improvement	0.21	0.11	0.03
20% Clean Screen	-1.29	-0.69	-0.20
$16M Scrappage	3.52	2.81	1.79
Total Reductions	**3.79**	**2.96**	**1.83**
Program Costs ($/2yrs)	**$78,358,444**	**$38,316,134**	**$23,512,637**
Cost Effectiveness ($/ton)	**$28,329**	**$17,739**	**$17,560**

* Negative emission reduction numbers represent an increase in emissions.

These estimates assume that 100 percent of the vehicles targeted for each strategy have owners that actually participate as intended. In reality, participation rates are likely to be significantly lower. Therefore, achieving the level of emission reductions presented in the table would require targeting of a larger number of vehicles and penetrating deeper into the vehicle rankings for each strategy. The added expense of doing so would raise the cost per ton of emissions reduced. In this regard, the cost and benefits in the table can be considered best-case estimates.

Although the data indicate that a large RSD program will yield more emission benefits, smaller implementations were found to be more cost effective because RSD collection costs per unique vehicle receiving a valid, DMV-matched, RSD reading are less for smaller programs. This is true because duplicate readings on the same vehicle occur less frequently for smaller programs, and because smaller RSD programs can receive a greater percentage of their data from the most productive test locations (i.e., streets with high vehicle volumes and conditions that yield a high percentage of valid readings). RSD data collection costs were estimated to vary from 50 cents for a small program to one dollar for a larger program per unique vehicle identified with a valid, DMV-matched RSD reading.

The benefits and costs of using VID information to carry out the I/M strategies evaluated are presented in Table 1-7. The results when using RSD data in combination with the VID are also presented, but represent only the incremental benefit and incremental cost of adding the RSD data to the analysis. As stated earlier, VID data is available for all vehicles subject to Smog Check. Therefore the targeting percentages shown are with respect to the entire portion of the California fleet that is subject to I/M and is beyond the 6 year new-exemption period.

Table 1-7. Costs/Benefits of Using VID Information for Multiple Strategies

Strategy	% of I/M Fleet Targeted	Number of Vehicles Targeted	Emission Benefits (tpd HC + NOx)	
			VID	VID + RSD (Incremental Benefit)
Off-Cycle Call-In	5%	669,403	6.29	0.32
Clean Screening	20%	2,677,614	-3.23	0.36
Scrappage	0.44% ($16M)	58,908	4.76	0.18
Totals	**25.44%**	**3,405,925**	**7.83**	**0.86**
Costs			$10,274,169	$53,535,614
Cost Effectiveness			**$1,798**	**$85,657**

* Negative emission reduction numbers represent an increase in emissions.

Costs to implement the strategies using the VID alone are only a small fraction of the costs associated with using RSD data for the same purposes because no additional data collection costs are required to take advantage of the VID. When combined with the larger emission reductions resulting from the ability to target a much larger portion of the fleet, the combined-strategy benefits using the VID without RSD were found to be very cost effective at just under $1,800 per ton of HC + NOx reduced. Adding RSD data to the ranking models was found to produce a small incremental benefit; however, the high associated RSD data collection costs result in a poor incremental cost effectiveness of approximately $85,000 per ton of emissions reduced.

Question 6: Can remote sensing technology be used as a tool to periodically verify the emission reductions achieved by the Smog Check program?

Answer: Yes, but with some limitations

Although RSD would generally be unable to quantify the benefits of Smog Check on a per vehicle basis, differences in vehicle emission levels taken before and after regular Smog Check inspections on a fleet-wide basis were observed within the RSD database. The differences were successfully used to demonstrate that sufficiently large RSD databases (which help minimize operating condition, traffic pattern, site selection, ambient conditions, and other variables) can be used to make estimates related to the benefits of the Smog Check program and to evaluate Smog Check station performance. However, the sizes of the estimated benefits were not always statistically significant. Also, the RSD data is limited to tailpipe emissions, and does not provide information about tampering, evaporative emissions, or on-board diagnostics results. An improved understanding through additional research of the relationship between RSD, ASM, and Federal Test Procedure (FTP) emission rates, and the influence of factors such as vehicle operating conditions and traffic patterns on RSD readings, would likely lead to more accurate estimates of the benefits of the Smog Check program using RSD. Further discussion on the methods used to estimate Smog Check benefits and the results of the analyses can be found in Section 8.1.

Question 7: Can RSD be used to characterize the California fleet with regard to Basic/Enhanced Smog Check areas, daily commute/weekend vehicle emissions contributions, magnitude of emissions from the entire in-use fleet to be used for emission inventory verification, and criteria for directing specific vehicles to test-only stations?

Answer: Yes, to a limited extent

Results from the study indicate that RSD can be used to correlate various vehicle usage patterns with emissions, to assess differences in vehicle emission levels by region, and to compare weekday/weekend emissions contributions from the fleet, although the sizes of the effects were not always statistically significant. The study results also indicate that RSD data can be used to estimate tailpipe emissions from the in-use fleet without having to estimate vehicle populations and annual miles driven. However, resulting estimates for the South Coast Air Basin were found to be significantly different than estimates created using California's EMFAC model. Further detail on the usefulness of RSD data to characterize fleet emissions can be found in Section 8.2.

The conditions under which the RSD data is collected impact the usefulness of the resulting database in terms of carrying out the type of fleet characterizations discussed with respect to Questions 7 and 8. Like a photographic portrait that is taken while the subject is blinking, the momentary emission data provided by RSD for a given vehicle may not fairly represent the vehicle's normal emission performance unless RSD data are appropriately taken and analyzed.

Summary

The pilot study revealed that, unless costs associated with the implementation and administration of an RSD program can be reduced, the cost of using RSD to select individual vehicles for special action **within the Smog Check program** generally outweighs the estimated benefits. Because the study was conducted in the context of the existing Smog Check program, RSD must be capable of predicting the future Smog Check ASM emissions test results of individual vehicles in order to generate emission benefits. Thus, sources of variability impacting the results include, along with variability associated with RSD measurements and actual vehicle emission performance, variability introduced by the Smog Check program itself (e.g. vehicle owner behavior and inspection station accuracy). As a result, an elevated RSD reading becomes more of an ASM failure risk factor rather than a reliable predictor of future ASM test results. Overall, the study found that the use of vehicle information and historic Smog Check data included in the VID can accomplish the same objectives far more cost effectively than RSD, because the VID covers virtually the whole fleet of vehicles subject to Smog Check without the need for additional data collection, and has predictive power comparable to RSD in targeting vehicles for special strategies.

RSD data was successfully used within the pilot program to generate relevant, but limited, information on the effectiveness of the Smog Check program and characteristics of the

California fleet. An RSD program that collects approximately 5 million records per year (at an estimated cost of approximately $3.3 million) would provide a database of sufficient size to carry out such analyses. The study did not evaluate the comparative costs and benefits of using RSD for fleet characterization in relation to other emissions data collection methods.

2.0 Introduction

The State of California has conducted a pilot study to evaluate whether vehicle remote sensing devices (RSD) can be used to enhance the California Smog Check program. The study was co-managed by the Air Resources Board (ARB) and the Bureau of Automotive Repair (BAR). Information for the conclusions of the study came not only from data collected in California, but also from existing RSD programs in the U.S. and from other recent RSD studies. The main goals of the project were expressed by ARB and BAR through a set of seven questions:

1) Can remote sensing technology be an effective tool to identify high-emitting vehicles between regular inspection cycles, and to document the emission reduction benefits of such a program?

2) Can remote sensing technology be an effective tool to "clean screen" vehicles and exempt them from the next scheduled Smog Check inspection, thus reducing program costs?

3) Can remote sensing technology be an effective tool to identify vehicles that would be, based on the vehicle emission levels (and overall condition), candidates for early retirement (scrappage)?

4) Can remote sensing technology be used to improve the State's high emitter profile (HEP), used to direct vehicles to test-only stations?

5) Can a permanent remote sensing technology program be cost-effectively implemented in California, and what would be the most cost-effective design for such a program?

6) Can remote sensing technology be used as a tool to periodically verify the emission reductions achieved by the Smog Check program?

7) Can RSD be used to characterize the California fleet with regard to Basic/Enhanced Smog Check areas, daily commute/weekend vehicle emissions contributions, magnitude of emissions from the entire in-use fleet to be used for emission inventory verification, and criteria for directing specific vehicles to test-only stations?

This report answers those seven questions and makes specific recommendations about how RSD might effectively be used by California. Before answering those questions, we first discuss the events leading to this pilot study, the technology of RSD, and how the study was conducted.

2.1 History of Commitment to Perform RSD Study

The technology of RSD has been investigated in California since 1989 [1]. Some of those studies have resulted in recommendations for how RSD could be used to reduce vehicle pollution, including ways to improve the Smog Check program as it existed at that time.

Recommendations for using RSD to improve Smog Check have been repeated in other types of projects. The ARB/BAR's first Smog Check evaluation report, in 2000, recommended improving the program's effectiveness through the use of RSD, primarily to identify high emitters and to "clean screen" vehicles. In another Smog Check Evaluation report from 2004, the contractor suggested that RSD might also be useful for testing some 30-year old and older vehicles that are exempt from I/M, but are still being used frequently. ARB and BAR wanted to evaluate these recommendations in a California context, which led to the current contract.

2.2 RSD Technology Discussion

Short History - Vehicle remote sensing is an adaptation of a laboratory analytical technique called long path photometry. This technology has been adapted for on-road use to determine the concentration of pollutants emitted by vehicles as they are normally driven on streets and highways. Although it has been used in limited ways since the 1970's, it has only been intensively developed for on-road vehicle emissions measurement since the late 1980's. During the mid-1990's the technology matured to the point that it was being used as a tool for gathering large amounts of emissions information for vehicles in a given area. As of 2006, the states of Virginia, Missouri, Texas, Colorado, and Georgia had year-around RSD programs of various sizes and purposes.

Since the development of vehicle RSD technology, several companies were formed to sell RSD technology. RSTi (Remote Sensing Technologies, Inc.), Hughes-SBRC (Santa Barbara Research Center), and MDLasertech each offered RSD systems for sale beginning in the mid-1990's. However, as the market matured, it also consolidated. Each of these companies left the business, sold their technology to a competitor, or merged with a competitor. As of the time of this report only ESP (Environmental Systems Products) is a significant presence in the United States RSD market.

Current State of RSD Technology - Vehicle remote sensing devices (RSD) measure the ratio of pollutant concentrations in vehicle exhaust to the carbon dioxide (CO_2) concentration in the exhaust. The measured ratios are used to calculate the concentration of pollutants in the exhaust. Those calculations are based upon basic chemistry assumptions for the combustion of

gasoline. RSD units do this in less than a second, as the vehicles are driven past an RSD site on the side of the roadway. RSD can measure up to one vehicle each second. So, at a site with high traffic volume, it is possible for RSD to compile a large number of emissions "snap-shots" from many vehicles in a short period of time.

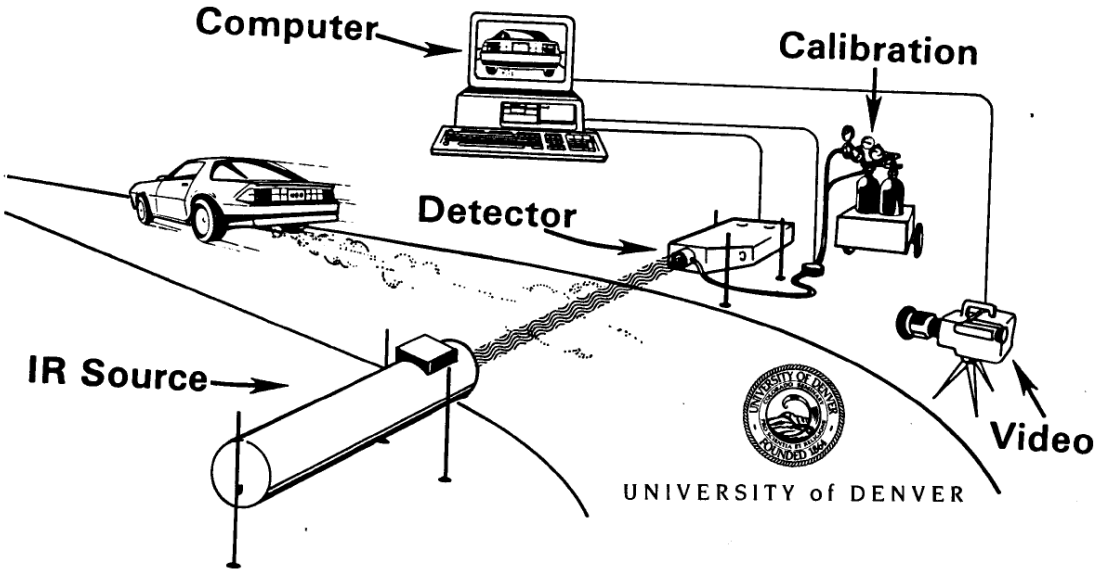
Vehicle RSDs use infrared and ultraviolet light beams, transmitted across the roadway, to make the measurements. A picture of a typical RSD set up used during this project is shown in Figure 2-1. A sketch of the concept of RSD is shown in Figure 2-2. As vehicles pass through the invisible beams, the changes in the transmitted light are an indication of the concentrations of the pollutants. The measured pollutants are usually carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxide (NO), but some systems can be configured to measure other pollutants. The opacity of the exhaust (i.e., how much smoke particles in the exhaust block and scatter light) can also be monitored.

Figure 2-1. Photo of RSD Measurement Site from This Study

In the case of high ambient pollution levels, the relative concentrations detected by RSD are corrected for the ambient pollutant levels measured just before the vehicle passed. The corrected ratios of the other pollutants to CO_2 are used in an equation derived from basic combustion chemistry to report undiluted, dry pollutant concentrations in the exhaust. This is the way pollutants in California's Smog Check program are also reported. In other words, these are approximately the pollutant concentrations that would be measured at the exit of the vehicle's tailpipe if the water vapor in the exhaust were removed.

Figure 2-2. Sketch of the RSD Concept

(Source: University of Denver, http://www.feat.biochem.du.edu/whatsafeat.html)



Average speed and acceleration are also measured to help determine the operational mode of the vehicle. This helps analysts determine when "off-cycle" operation is occurring (for example, aggressive acceleration, when vehicles can be expected to have higher than normal emissions). This also helps reduce analysis errors caused by wrong assumptions about how the vehicle was being driven when the measurement occurred. The average speed is calculated from multiple speed measurements taken as the vehicle passes. A typical system uses lasers across the roadway to determine the time it takes for the tires of a vehicle to travel from one laser to another. The multiple speed measurements are also used to calculate the acceleration of the vehicle. In other words, the acceleration is how much the speed of the vehicle changes as it passes by the RSD site.

Images of the license plates are also typically recorded for matching the vehicle to registration records. A picture of the license plate is usually obtained by a digital camera that is triggered by the RSD system as it measures the vehicle's speed. Add-on systems exist to automatically read the license plate of the vehicle from the digital image. However, when data were collected for this project, these systems were still in development and did not prove to be useful. Therefore, in this project, it was necessary to visually examine each digital image and manually enter the license plate characters into a database.

3.0. Project Overview

3.1 ARB/BAR Cooperative Project

The study was co-managed by the ARB and the BAR through an interagency agreement. The contracting agency was ARB. Both agencies managed the technical aspects of the project. Both ARB and BAR provided crews to collect RSD data. ARB helped manage encroachment permits and coordinated the schedules of the RSD crews. BAR managed the maintenance of the RSD equipment and fielded a crew to pull over vehicles (with the help of the California Highway Patrol) for the purpose of conducting roadside ASM inspections.

3.2 ERG Contract Elements

The contract was organized into two tasks. Task 1 was a field data collection and analysis task to collect RSD data and test and repair data in California. Task 2 was a literature review of relevant results from previous studies and existing RSD programs.

Task 1 Overview - The field data collection task was to collect at least one-million valid, unique RSD measurements on vehicles registered in California. These were to be a valid representation of vehicles registered in the different I/M area types (e.g., Basic and Enhanced) that fairly represent all model years in the fleet, and cover all socio-economic strata of vehicle owners in California.

In addition to the RSD emissions data, other types of emissions data were to be collected to help evaluate the impact of using RSD to augment the Smog Check program. For example, inspections were to be performed on some vehicles immediately after they had received an RSD measurement, and regular Smog Check data for some vehicles were also to be obtained. Other data such as responses to incentives for test and repair, incentives for scrappage, and public opinions were to be collected to help answer questions about the feasibility and cost of various possible forms of an RSD program in California.

Task 2 Overview - The literature review task was to review previous and current studies on relevant remote sensing programs. The report resulting from the review was to provide an organized synthesis and critical assessment of the results and findings of the studies.

To the extent possible, the literature review was also to answer the seven objectives of this study, define research gaps in the RSD field, establish the need for further RSD studies, and resolve controversies about RSD, if any.

We describe these tasks in greater detail below. Task 2, the Literature Review, is described first because it began first and its results helped influence how Task 1, the Field Study, was conducted.

3.3 Literature Review

The studies assessed in the Literature Review included several relatively large-scale efforts, as well as several papers that looked at the capabilities and limitations of RSD technology. Generally, we limited our review to more recent studies that used newer generation equipment, measured vehicle speed and acceleration, and used improved quality assurance procedures relative to earlier studies. In parallel with the literature review, several existing RSD programs were reviewed to obtain actual operating results relevant to this study.

The results of the literature review are detailed in a report titled, "Review of Literature on Remote Sensing Devices" [2]. In that report twelve studies are summarized with regard to how they relate to the questions being asked by ARB and BAR in this study. The literature review report was co-authored by several RSD experts with widely varying opinions on the abilities and appropriateness of using RSD to improve Smog Check. Each author contributed significantly to the report's findings. The authors debated their interpretations of the results from the studies until they reached common ground and could agree on how to present the results and recommendations.

3.4 Field Data Collection

Teams from ARB and BAR used equipment owned by BAR to collect over two-million raw, single and dual-hit RSD measurements in the major metropolitan areas of the state. Single hit RSD measurements are obtained when one full emissions, vehicle, and speed measurement system is in place at any RSD site. A dual hit consists of two separate full RSD systems capturing two separate emissions, license plate, and speed readings for each vehicle going by the site. This resulted in about 1.4 million valid measurements on vehicles registered in California.

The full RSD sample was used by ERG to develop answers to the questions posed in the contract. We used the data to develop a simulation of the California I/M fleet (described in Reference 3) to estimate emissions reduction and cost effectiveness for various strategies that could enhance the current I/M program. Details on the construction of these estimates are presented in Reference 4. We also used the RSD readings to characterize the emissions of the California fleet to evaluate the I/M program.

To evaluate the fleet emissions benefits that could be achieved with RSD data, we needed to quantify the benefits to individual vehicles. Finding a low-cost method for collecting emissions reduction measurements of a large sample of vehicles without biasing the results was a major challenge of the field data collection effort. Initially, many owners of vehicles measured by RSD were mailed invitations to have their vehicles inspected, and repaired if necessary, at no cost. Others were offered a $50 incentive to have their vehicle simply inspected at various types of I/M stations. An extremely low response rate to these types of mailings inspired new strategies that allowed various aspects of an RSD program to be evaluated in a more cost-effective way. As a result, ERG developed a way to estimate benefits using I/M results that occurred naturally, that is, as vehicles participated in the I/M program in their normal course, after they received an RSD measurement.

In addition, more than 1,000 of the vehicles that were measured by RSD were also pulled over and given a roadside ASM inspection by BAR. These vehicles were chosen using stratified random sampling to make sure the data could be used for projecting the results to the fleet of the entire state. The drivers of nearly 500 of the pulled-over vehicles were invited to have their vehicle voluntarily inspected at a Referee station in return for a $50 incentive. The data from those who participated were useful for helping compare voluntary inspection results to mandatory Smog Check inspection results. Some of the results of that effort are described in Section 9.3.

Other important data collected and analyzed include nine years of Smog Check data, the physical configuration and traffic pattern data for every on-ramp in the Sacramento area, and large samples of data from Missouri's RSD program and from Virginia's latest Pilot RSD program.

4.0. Evaluation of Other RSD Programs and Reports

The Paper Study was an assessment of recent studies on relevant remote sensing programs. Information from the Paper Study helped answer the objectives specified for the field data collection (Task 1), defined research gaps in RSD knowledge, established the need for further RSD studies, and where possible, resolved controversies about RSD.

Still, using a paper study of earlier studies has its limitations. The goals of past studies did not necessarily coincide with the goals of this new study. While past studies generally contain useful information, most do not include a comprehensive analysis that looks at the incremental benefit and incremental cost effectiveness of an RSD component that is supplemental to an existing IM program, as was sought in this study. Many of the reviewed reports do not include a complete analysis of all of the costs of operating a program. In addition, many do not look at other alternatives and compare those alternatives to RSD. Some studies were sponsored by or written by an RSD company. Nevertheless, with appropriate objectivity, this review of existing work did provide a basis for beginning this major new study in the field of RSD application. The reader should keep in mind that the Paper Study was performed at the beginning of this project, which was long before any of the results of the analysis of field data were known.

ERG chose the experts to perform the paper study to represent a wide set of viewpoints on the merits of RSD [2]. Since the merits of RSD are still being debated in the vehicle pollution control field, we felt it was important that a wide range of views be weighed in interpreting the results of other studies. Each reviewer contributed significantly to the report's findings through their participation in the iterative process of debating important issues and helping revise how agreed upon interpretations were presented.

4.1 Reports Reviewed

The literature reviewed in the Task 2 report focused on several relatively large-scale studies as well as several papers that assessed the capabilities and limitations of remote sensing. Generally, we limited our review to more recent studies that used newer technology equipment, measured vehicle speed and acceleration, and used the most current quality assurance procedures for both data collection and data analysis. The reports reviewed in Task 2 covered the following programs:

1) Denver Pilot Study of Remote Sensing for Clean Screening (1999)

2) Infrared Remote Sensing Of On-Road Motor Vehicle Emissions In Washington State (1999)

3) Oregon Remote Sensing Study (2003)

4) Virginia Pilot Remote Sensing Device Study (2002)

5) Evaluation of On-Board Monitoring Devices for Qualifying Taxis in California (2003)

6) Gateway (St. Louis, Missouri area) Clean Air Program Annual "Rapid Screen" Report (2002)

7) Remote Sensing Device High Emitter Identification With Confirmatory Roadside Inspection in California (2001)

8) The Coordinating Research Council's E-23 Program (multiple reports, such as "On-Road Remote Sensing of Automobile Emissions in the Chicago Area") (1997 -- 2004)

9) Evaluation of Remote Sensing in Arizona (2002)

10) Using Remote Sensing Devices (RSD) to Evaluate the California Smog Check Program (1997)

11) On-Road Emissions Changes Due to IM240 Inspection/Maintenance and Oxygenated Fuel Program in Denver (1997)

12) Analysis of Data from the California I/M Pilot Program/Assessment of RSD (1995).

Our team reviewed these reports to find information relevant to the situation being studied in California. Although none of the studies were researching RSD in the same way as required in the California Pilot study, most of them provided information useful in answering some parts of the primary questions of this study. After having reviewed the reports, assessed their relevance to the current study, and debated the interpretation of their results, ERG's team of RSD experts agreed that:

1) RSD can be used to "clean screen" vehicles. (It is currently used in Missouri and Colorado for clean screening.) Compared to equally effective methods based upon vehicle characteristics and/or I/M inspection histories (often called "vehicle profiling"), RSD has the advantage of providing an on-road measurement. However, compared to those same methods, which do not require an on-road measurement, RSD is costly and complex to perform.

2) RSD has potential for the following tasks, but further study is needed to determine if it would be effective (especially cost-effective) for:

   a. Identifying high emitters for immediate testing;
   b. Identifying vehicles for scrappage programs;
   c. Improving the accuracy of the "high emitter index" used to identify vehicles that are likely to fail the Smog Check test;
   d. Evaluating the overall effectiveness of the Smog Check program; and
   e. Characterizing emissions from subcategories of the California fleet.

Therefore, the reviewers recommended further study in the field data collection task for all but the first of the above questions.

4.2 List of RSD Programs in Other States/Areas

During the course of this study, ERG discussed existing RSD programs with their administrators in other states. As of the time of the study, four other states had large, on-going RSD programs: Colorado, Missouri, Georgia, and Texas. Virginia was beginning an RSD program, but did not yet have significant results. Several other states collect a small amount of RSD data every year to comply with EPA requirements for an enhanced I/M program, but these programs are not large enough nor of a design to merit discussion here.

The four programs are summarized in Table 4-1. The Colorado and Missouri programs are using RSD to clean screen vehicles from their I/M programs. These programs are similar in that both are run by a contractor, they advertise the location of RSD equipment, and they send eligibility notices by mail. Vehicle owners who receive a notice and choose to be clean screened, pay a fee for the convenience. In the first year of the Colorado program, RSD measurements and owner responses to eligibility notices were obtained for only approximately 4% of the vehicles eligible for an RSD clean screen. In Missouri, the clean screen program has been running longer and has a higher participation rate. There, owners of approximately 19% of the vehicles eligible for RSD clean screen responded to the clean screen notice.

The Georgia RSD program, which has been in operation since 1996, was started to collect on-road emissions information and to evaluate the I/M program operating in the Atlanta area. The data are collected and analyzed by researchers from the Georgia Institute of Technology. Although the data collection is funded through the I/M program fees, coordination with the I/M program is minimal. Every year the RSD data are used to evaluate the I/M program by comparing RSD measurements on vehicles in non-I/M areas of the state to vehicles in the Atlanta I/M area.

Table 4-1. Summary of RSD Programs in Other States

State	Type	Decision Method	Program Year	Annual Valid RSDs	Participation Rate*
CO	Voluntary Clean Screen	2 measurements less than HC and CO cutpoints	1st	>1-million	4%
MO	Voluntary Clean Screen	2 measurements less than HC, CO, and NOx cutpoints	3rd	5-million	19%
GA	Program Evaluation	n/a	12th	350,000	n/a
TX	Mandatory Dirty Screen	2 measurements greater than HC, CO, or NOx cutpoints	6th (1st year of strict enforcement)	12-million	80% (approx.)

* The fraction of notice recipients who participated.

Texas' RSD program was set up to identify vehicles that regularly drive into an I/M area, but are not required to have an I/M inspection because of where they are registered. About four years after the program began, under a new contractor, Texas started to identify a small fraction of the fleet as gross-emitters using the RSD data. They began sending notices to some of the owners of the suspected gross-emitters to have their vehicles ASM inspected, and repaired if necessary. A few years later, even though the number of notices remained small, Texas began a strict enforcement program to fine those who were not responding to the notices. The strict enforcement had recently begun as the California Pilot RSD project was being conducted, so the final results of the Texas gross-emitter program were not available for this report.

5.0 Summary of RSD Data Collection in California

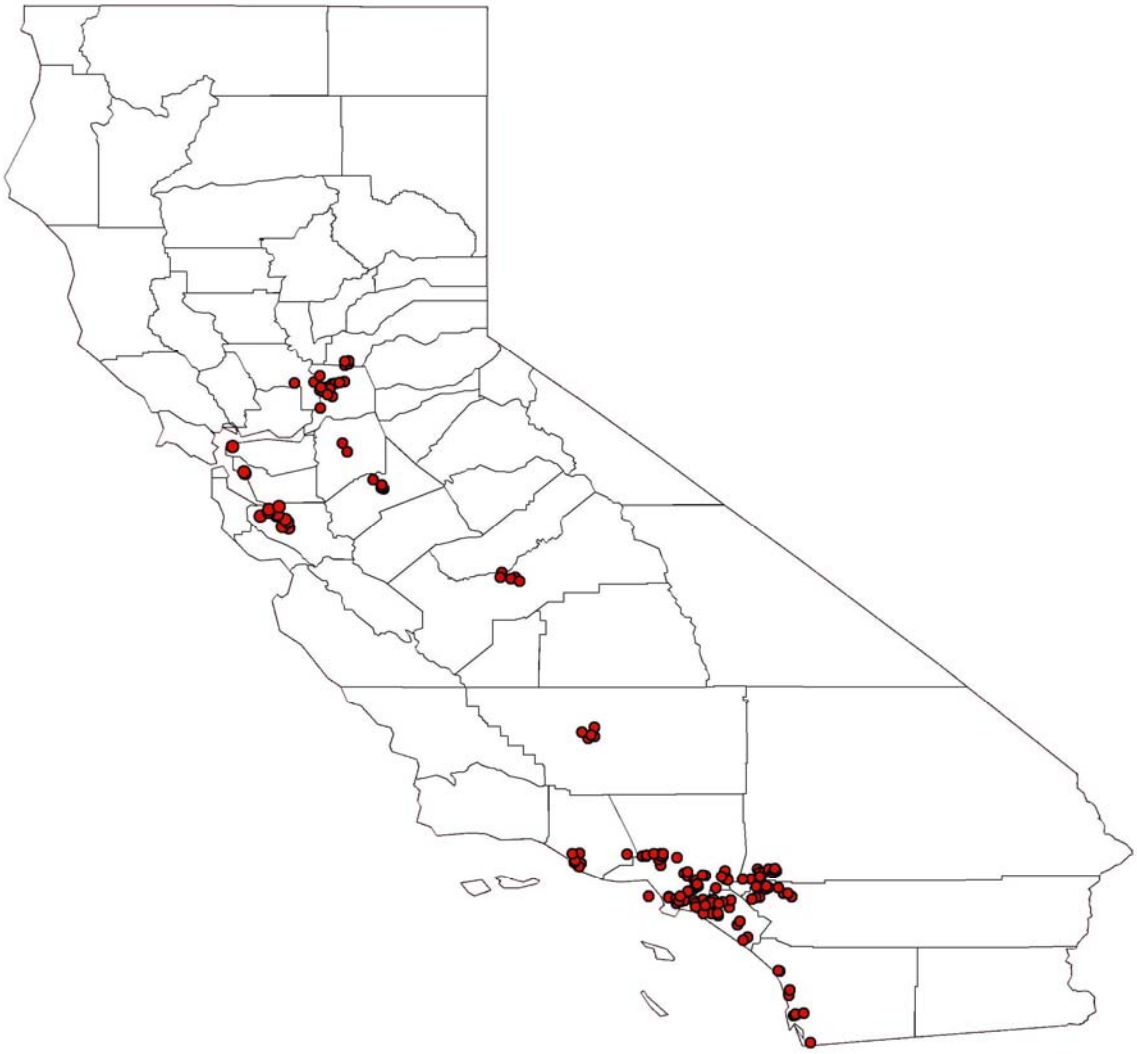
The contract specified that California RSD data be collected in a way that is representative of the California fleet. Therefore, it was important that RSD data be collected from specific locations around the state, during various times of the year. ERG proposed a draft data collection plan in response the RFP for this project. Several revisions to the data collection plan were necessary after consultation with ARB and BAR and after performing the literature review. Only the final data collection plan is referred to in this section.

5.1 Description of RSD Data Collection Plan

The RSD data collection plan called for the collection of over one-million unique, valid data points from around the state. These data were to be collected continuously over a 12-month to 18-month period beginning in October, 2003. On a typical day two or three RSD crews would collect data (i.e., at two or three data collection sites per day). Data were to be collected in both northern and southern California in areas where nearly 90% of registered vehicles are located. Less populated areas of the state, outside of the five largest Air Quality Management Districts, were not targeted in the data collection plan. We relied on the facts that the data were to be collected from a wide range of areas and over a long time period to make the sample representative of the California fleet.

In southern California, data were collected by ARB and BAR crews from the San Diego area up to the Bakersfield area. In the central part of the state, the Fresno/San Joaquin valley area, staff from BAR collected the RSD data. In northern California, crews from BAR and from a subcontractor to Eastern Research Group collected data in the Stockton, Sacramento, and San Francisco Bay areas. Figure 5-1 shows the location of the RSD measurement sites for this study.

Figure 5-1. Location of RSD Measurement Sites for the Study



5.2 RSD Records Collected

Nearly 2.2 million "raw" remote sensing records were collected from March 15, 2004 through January 24, 2005. This does not include the data collected before some RSD equipment problems were resolved (described later). These raw data were quality assured in two phases — in the field and after the data were processed. In the field, calibration gases were frequently used to assess the accuracy of the instruments, and adjust them if necessary. Sometimes a special audit truck was driven past RSD equipment to see if its simulated exhaust would be accurately measured. As vehicle exhausts were measured, software controls applied filtering formulas to categorize the data as either "valid" or "invalid." After the data were processed and delivered to

the ERG team, the license plate images were transcribed and the data were matched to recent California registration data and to California's I/M program Vehicle Information Database (VID). Then, the data were further processed to apply a second tier of data validity assessments. Finally, the data were ready to use to help answer the seven questions of the project [3].

Table 5-1 summarizes the reduction of the California RSD data for this project. 71% of the raw records were successfully merged with registration data from the California Department of Motor Vehicles (DMV), using the vehicle license plate. Visual inspection of the video of a sample of the vehicles indicated that the majority of remote sensing records that could not be merged with registration data had obstructed license plates (by a trailer or hitch) or unreadable license plates (because of extreme contrast or glare). The unmatched 29% of RSD measured vehicles were classified as being of unknown origin. This seemingly high unmatched rate is commonly seen in other RSD programs[4]. The table indicates that about 65% of the matched-with-registration-data measurements were flagged by the RSD equipment software as valid (valid emissions, speed, and acceleration results). This fraction also applies to the raw measurements, so about 1.4-million of the raw measurements (2.2-million * 65%) were flagged as valid by the RSD equipment software (not shown in Table 5-1).

Table 5-1. Reduction in Remote Sensing Measurements for Analysis (RSD Data Collected March 2004 – January 2005)

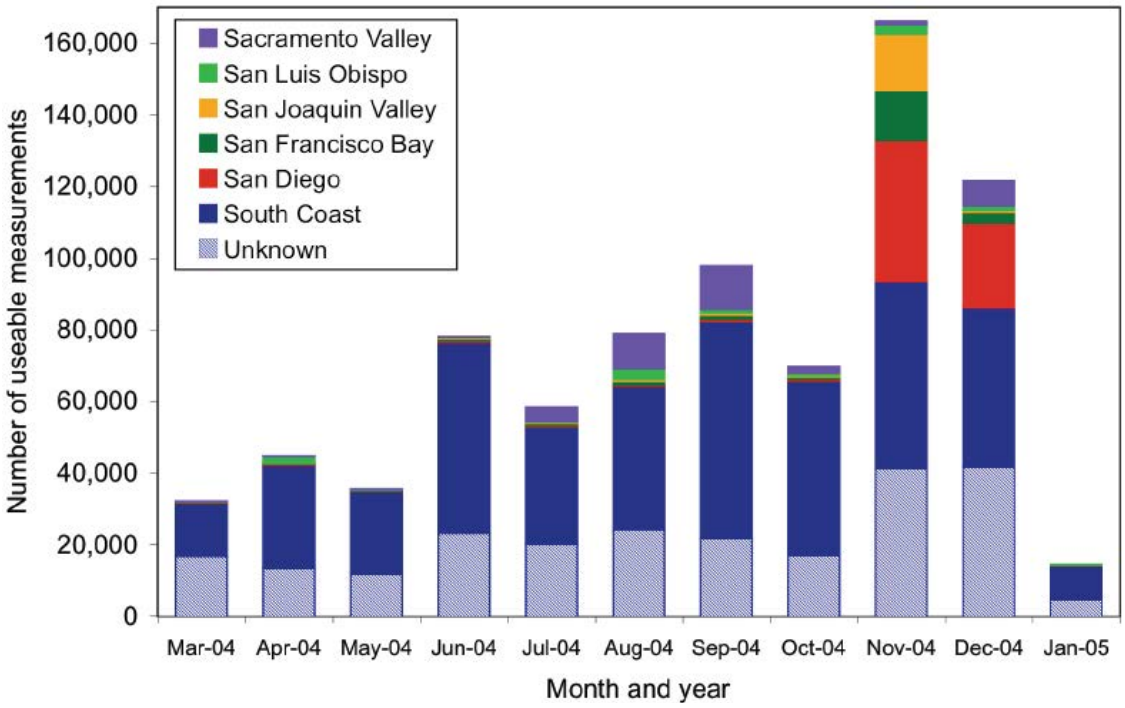
	Number	Percent of total	Percent of previous category [a]
Raw measurements	2,196,274	100%	NA
Matched with registration data	1,562,618	71%	71%
Valid RSD emissions measurement	1,010,794	46%	65%
Matched with previous Enhanced Smog Check	555,937	25%	55%
Matched to Roadside Pullover Inspection	1,040 [b]	0%	N/A [c]

Notes:
[a] The last column of Table 5-1 shows the percent of the previous category; for example, 55% of vehicles with valid emissions measurement also had a previous Enhanced Smog Check record. These vehicles represent 25% of all raw measurements (55% * 65% * 71% = 25%).
[b] Subsets of these 1,040 vehicles subsequently received emission inspections at I/M stations as described in Section 9.3.
[c] Roadside pullover vehicles were not chosen based upon Smog Check history, so they were not a subset of vehicles "Matched with previous Enhanced Smog Check."

[4] For example, in an annual report by Environmental Systems Products for the Missouri Clean Screen program the percentage of raw RSD readings that produced a license plate match to Missouri registration records was 56% (Peter McClintock, "Gateway Clean Air Program Annual Rapid Screen Report January – December 2002." Final report by Applied Analysis on behalf of ESP – Missouri for the Missouri Department of Environmental Resources, Jefferson City, MO, July 2003).

Figure 5-2 shows the distribution of RSD records for each month of data collection by the air basin in which the vehicle was registered for those RSD records that had valid RSD measurements, could be matched to the vehicle registration database, and whose speed and acceleration indicate they were driving in a way that produces representative vehicle emissions (VSP = 5 to 25 kW/Mg)[5, 6], which our fleet characterization analysts called "usable" measurements. As mentioned above, 29% of all remote sensing records could not be matched with registration data; these are the "unknown" category in the figure.

Figure 5-2. RSD Distribution by Month and Basin



To meet the objectives of field data collection while staying within the project budget, the number of RSD sampling teams was limited to three to four teams collecting RSD data at any one time. An individual team was assigned to work in a given area for certain periods to avoid excessive time traveling between areas. As a consequence, all areas were not sampled at all times. Figure 5-2 shows that on-road measurement of vehicles registered in the South Coast and Sacramento air basins occurred throughout the analysis period, whereas the measurement of vehicles registered in the San Diego, San Francisco Bay, and San Joaquin Valley basins occurred

[5] 1 Mg = 10^6g = 10^3 kg = 1 metric ton

[6] In this study we used 5 to 25 kW/Mg as the emissions-representative range. We chose this range based on work by J.L. Jimenez in his 1999 Ph.D. thesis Understanding and Quantifying Motor Vehicle Emissions with Vehicle Specific Power and TILDAS Remote Sensing. ESP uses 3 to 22 kW/Mg as their emissions-representative range. Sierra Research advocates using 4 to 14 kW/Mg as the appropriate emissions-representative range.

mostly in November and December 2004. A small number of vehicles registered in other air basins were also measured on road because they happened to be driving in one of the larger air basins.

5.3 Difficulties Encountered During Study

As in most projects that include a field data collection component, operational difficulties were encountered. Some of these difficulties caused longer than expected delays and data quality problems. But none of the difficulties was large enough to cause insurmountable problems in schedule or data quality. The most significant difficulties had to do with: 1) obtaining encroachment permits that are usually required for setting RSD equipment on the roadside, 2) working out software and equipment problems related to the new equipment, and 3) weather that prohibited the collection of RSD data.

Encroachment Permit Problems - Temporary encroachment permits are usually required before RSD equipment is allowed to be set up on the roadside. Unfortunately, two significant types of problems were encountered in the permitting process during this project — refusals and time restrictions. Permit refusals by CalTrans occurred mainly in the Fresno area, and prevented our teams from collecting any highway ramp data. Permit time restrictions occurred statewide. Our data collection teams were unable to collect both morning and evening rush-hour data at highway ramp sites due to the restrictions. These refusals and time restrictions caused data selection biases that had to be corrected for in various ways. For example, to estimate the fleet coverage RSD could attain in California, our analysts had to make assumptions based upon data from other states' existing RSD programs. In a research setting, these were not insurmountable problems, but if California ultimately decides to implement an RSD program of some kind, these permitting problems should be addressed.

Equipment Problems/Limitations - Equipment problems mainly related to the deployment of new, customized systems resulted in the rejection of a significant amount of data that was collected in the early part of the project. The RSD data collection systems used in this project were systems purchased by BAR in the summer of 2003. When the project began these systems were operational, but had not yet received their full acceptance tests from BAR. Due to the uncertain schedule of acceptance testing and the urgent schedule of the project, a decision was made to start data collection before the completion of the acceptance tests. This decision resulted in our having to reject data collected from October 2003 until March 15, 2004. We determined through our quality assurance of the data and consultation with BAR and the equipment manufacturer that the software running the equipment until that time had caused

several data quality issues. The two unacceptable issues were: synchronization of license plate photos with exhaust measurements and correction of pollutant measurements for changes in ambient temperature and pressure. These two issues were resolved with an RSD equipment software update implemented during the first two weeks of March 2004.

There was another, less serious equipment problem that reduced productivity and increased costs, but did not result in the rejection of any data. It had to do with the automatic license plate reader systems supplied with the RSD equipment. These were manufactured by Pulnix and are commonly used in a more controlled setting. These systems required setting additional equipment on the roadside, so set-up and take-down of RSD sites took longer when the Pulnix systems were used. This extra effort turned out not to be well-spent because the accuracy of the Pulnix systems of reading license plates was never consistent enough to rely upon. Consequently, all plates had to be transcribed manually.

Weather Problems - Current technology RSD measurements cannot be accurately obtained through air with liquid water in it. So RSD data quality will be questionable when the weather is foggy or when the roadway has enough standing water for vehicle tires to create a mist as they drive past. This was an expected data collection difficulty, so the work plan allowed for weather delays, especially during the fall and winter months. Due to seasonal rains and fog, this will always be an issue if California adopts a year-round RSD program.

6.0 Evaluation of RSD's Ability to Select Individual Vehicles for Special Strategies: Cost-Benefit Analysis Approach

The first five questions of this project direct the study to evaluate the incremental benefits of using RSD measurements to select individual vehicles to improve Smog Check. This section describes the approach to performing the cost-benefit analysis. The next section, Section 7, describes the results of the cost-benefit analysis.

The approach to determining the incremental benefits of using RSD to select individual vehicles for special strategies can be summarized by the following four steps:

- Select and formulate strategies that will answer the questions. (Section 6.1)
- Simulate the response of vehicles to the I/M program and strategies (Section 6.2)
- Calculate the fleet performance of a vehicle ranking method for a strategy:

  Rank vehicles based on probable individual vehicle benefits (Section 6.3)
  Estimate fleet benefits of the strategy (Section 6.4)
  Estimate fleet costs of the strategy (Section 6.5)

- Evaluate the effectiveness of RSD by comparing the fleet performances of a vehicle ranking method that uses RSD and a vehicle ranking method that does not use RSD (Section 6.6)

Each of the activities described above are discussed in more detail in the sections indicated at the end of each item in the list.

In the analysis for this study, we chose the ASM emissions test as the focus of the calculations for estimating the emissions benefits of the special strategies. The reason for our decision is that the ASM test is used during Smog Check for the majority of vehicles participating in the program. However, the analysis approach that has been used in this study for the ASM test could have just as easily been used for the Two Speed Idle test, which is used for the portion of the vehicle fleet that cannot be tested according to the ASM procedure. Beyond this point, this report will refer only to the ASM test.

As Section 6.1 will discuss, the analysis uses four strategies that are supplemental to the existing I/M program as a test bed for evaluating the incremental effectiveness of RSD (i.e., the benefit offered by RSD that is above and beyond the current program). The purpose of each strategy is to target vehicles for a special treatment that intervenes in their normal participation in the I/M program. Before a targeted vehicle is eligible for participation in Calling-In or

Scrapping strategies, the emissions performance of the vehicle will be verified by performing an ASM emissions test on the vehicle. These targeting verification tests are named after the strategy in which they are used (e.g., call-in ASM test and scrappage ASM test). While the targeting verification tests are regular Smog Check inspections, and we assume that they are performed at regular I/M inspection stations, they are used only for vehicles that are targeted for special strategies.

The discussion frequently refers to ASM failure probabilities (Fprobs). Several years ago, the concept of I/M emissions test failure probability was developed to assist in directing high-risk vehicles to high-performing inspection stations when they were due for an upcoming I/M inspection. Using historical VID data, failure probabilities were calculated as the fraction of all vehicles of a given description that failed their initial I/M emissions test. Vehicle description was defined by model year, make, model, and engine family. The notion was that if 20% of all vehicles of a given vehicle description failed their initial emissions tests, then the probability that an individual vehicle of the same description would fail its next initial emissions test would also be 20%.

In work that ERG did for BAR after the development of those first Fprobs and before this project, we saw that additional factors also influenced the ASM failure probability. These included the ASM cutpoints, the age of the vehicle, the time since the previous I/M certification, and the previous-cycle initial ASM test result. In this study, we have extended ASM failure probabilities to encompass these additional dependences. Adding these dependences greatly improved the usefulness of ASM failure probabilities while still maintaining the fundamental basis on which failure probabilities are based. The meaning of ASM failure probability remains unchanged. However, because of the added dependences, especially the time and cutpoint dependences, we have developed new ways in which failure probabilities can be used, including forecasting the probable mass emissions of individual vehicles.

6.1 Description of Special Strategies

In the analysis, the effectiveness and cost-effectiveness of adding RSD to Smog Check was evaluated in four different contexts as represented by the first four questions in the study. As a preliminary discussion for the description of the cost-benefit approach, we need to define the environment in which the RSD information will be used. Since the questions all involve supplementing the existing I/M program with an RSD measurement component, it is a given that all vehicles will be participating in the I/M program. For the 2004 calendar year (the year used for this study), the I/M program required biennial inspections on vehicles with model years from

1976 through 1998. All 1976 and newer vehicles were subject to change of ownership inspections.

The approach that we took was to codify each of the four questions into four different strategies that could supplement the normal I/M process: Calling-In, Directing, Exempting, and Scrapping. The correspondence between the questions and the strategies is shown in Table 6-1. The table also shows alternative terms commonly used for the different strategies. The alternative terms are used in the Executive Summary of this report. However, to be consistent with the modeling report [3] and the implementation report [4], the body of this report uses the terms listed under Strategy in Table 6-1.

Table 6-1. Four Strategies to Evaluate RSD's Individual Vehicle Selection Performance

Question	Strategy	Alternative Term
Can remote sensing technology be an effective tool to identify high-emitting vehicles between regular inspection cycles and to document the emission reduction benefits of such a program?	Calling-In	Off-Cycle Call-In
Can remote sensing technology be used to improve the state's high emitter profile (HEP), used to direct vehicles to high-performing stations?	Directing	HEP Improvement
Can remote sensing technology be an effective tool to "clean-screen" vehicles and exempt them from the next scheduled Smog Check inspection thus reducing program costs?	Exempting	Clean Screen
Can remote sensing technology be an effective tool to identify vehicles that would be, based on the vehicle emission levels (and overall condition), candidates for early retirement (scrappage)?	Scrapping	Early Retirement

A special strategy is any effort that is used to enhance the effectiveness or cost-effectiveness of the I/M program. It is important to understand that all of these special strategies can operate with or without RSD information. For example, it is quite simple to select vehicles for all four strategies based simply on model year. The overall question in this study is if RSD information is available, does it cost-effectively provide any incremental benefit to enhance the performance of the special strategies. Therefore, to evaluate the benefits and costs of adding RSD to the special strategies, we need to determine the difference in costs and the difference in benefits of performing the special strategies with RSD and without RSD. If the benefits of using RSD for identifying vehicles for special strategies can be obtained at reasonable cost, then

routinely acquiring the RSD measurements on individual vehicles will be attractive. One benchmark for judging cost-effectiveness is the Carl Moyer criterion of $14,300 per ton of HC + NOx emissions.

We had to clearly specify the details of each strategy in order to perform engineering calculations that would produce costs, benefits, and cost-effectiveness. While we chose the specific details of each strategy to represent likely characteristics, other choices for the details are certainly possible and would produce somewhat different numerical results. The strategies as described below are intended to convey the basis of the analysis results and are not intended to represent recommendations for optimally designing strategies. Nevertheless, we believe that given the wide range of types of strategies that we investigated, the general results of other analyses would be substantially the same as the results presented here. The descriptions that follow provide more detail about the four special strategies used in this analysis.

Calling-In – In this analysis, we considered Calling-In at any time in the I/M program cycle. We performed benefit calculations for one Calling-In option. This chosen option is called Calling-In No-Sticker in which vehicles that are a high risk to the I/M program would be targeted mid-cycle for a call-in ASM test (the targeting verification test) at any I/M station. If the vehicle failed the test, the vehicle would be required to be repaired and to pass a follow-up ASM test. However, the vehicle would not be given an emissions certification but would be required to continue on its existing regular I/M program schedule. The other policy option, which was not used in this analysis, is called Calling-In Sticker. In this case, the vehicle would also be subject to a call-in ASM test and would be required to be repaired and to pass a follow-up ASM test if it failed. However, the vehicle would then be issued a new biennial certification. This would put the vehicle in a new regular I/M schedule. We chose to present the results of Calling-In No-Sticker in this analysis because we found that this option produced larger benefits than the Calling-In Sticker option.

Directing – Directing would occur for vehicles that are a high risk to the I/M program and are expected to soon receive their biennial inspection. For Directing, vehicles would be required to be inspected at high-performing stations instead of average-performing stations.[7] Directing, which is now being performed within Smog Check, is currently based on gross

[7] High-performing station is a hypothetical category of California I/M inspection stations that would perform more-accurate I/M inspections and therefore would be able to provide greater emissions reductions than average-performing stations. In the analysis we did not attempt to determine which stations or which types of stations (Test Only, Test-and-Repair, Gold Shield, etc.) were average- or high-performing. Instead, based on station-performance information from BAR, this study assumes that the hypothetical high-performing stations have fail rates that are 20% higher and after-repair emissions levels that are 20% lower than those of average-performing stations.

polluter assignments or the current HEP. The notion of Directing is based on the premise that high-performing stations are less prone to inaccuracies than are average-performing stations.

Investigating the benefits and costs of Directing was done to answer the question "Can RSD be used to improve the High Emitter Profile (HEP), which is used to direct vehicles to high-performing I/M stations?" In this study we developed eleven different methods that can be used to rank vehicles for Directing. Each of these eleven different ranking methods is an HEP. Some methods use individual vehicle RSD measurements as inputs; some do not. We worked hard to make all eleven HEPs as effective as possible based on the inputs being used. By comparing the best method for Directing that includes RSD information with the best method for Directing that does not, we can answer the question of how much the best RSD HEP exceeds the best non-RSD HEP.

Exempting – Like Directing, Exempting would also occur shortly before vehicles are expected to appear for their biennial inspection. Vehicles that are expected to be a low risk to the I/M program would be ranked higher on an Exempting list. Vehicles that are exempted would be given a certification without coming in for a regular I/M test. Exempted vehicles would be expected to appear two years later for their next biennial inspection in accordance with their new certification unless they were exempted again. Exempting is expected to always slightly increase emissions of the I/M fleet because a few vehicles will inevitably be incorrectly exempted. The goal of the vehicle prioritization is to preferentially exempt vehicles that represent the smallest risk.

Scrapping – In this analysis, we considered Scrapping for vehicles at any point in their I/M program cycle. For these calculations, scrappage candidate vehicles would be called in for a scrappage ASM test (the targeting verification test) that would be performed at a regular I/M station. If the vehicle failed the test, the State would offer to purchase the vehicle from the owner. If the vehicle passed the scrappage ASM test, the vehicle would be released without issuing a new certification. Scrappage candidates would be selected from the fleet based on their estimated FTP mass emissions over 24 months per dollar of vehicle value. By using this ranking variable, the state will come close to maximizing the total mass of emissions that are reduced through the purchase and scrapping of candidate vehicles.

An example will serve to demonstrate how the Calling-In strategy could be implemented in the context of the existing I/M program. Suppose that the existing California I/M program were supplemented by a regular RSD measurement program. Each week, the previous week's RSD measurements that were declared valid and matched to registration records by the RSD

vendor would be provided to a central office. The job of the central office would be to target the vehicles in the set that would be expected to benefit most from being called-in off-cycle. The central office would use software that would rank the vehicles from those that would benefit most to those that would benefit least from the call-in using the available information on each vehicle. The available information would be the RSD measurements, historical inspection records as documented in the VID, and a description of the vehicle in terms of model year, make, model, engine, and emission control equipment. The central office would target the highest ranked vehicles starting at the top of the list and moving down until a specified percentage of the vehicles were targeted. In this analysis, we refer to this percentage as the **targeting percentage** or the **penetration**. The central office would instruct the owners of the targeted vehicles to go to an I/M station for a call-in ASM. Those vehicles that failed the call-in ASM would be required to be repaired until they passed a follow-up ASM.

The discussion above about the details of the strategies and how they could be implemented demonstrates that the ability to rank individual vehicles is key. Methods that can rank vehicles better will produce better-performing strategies. If RSD can help rank vehicles better, then RSD can improve a special strategy. Many different approaches can be used to rank vehicles for special strategies but the one piece of information that is most desired is a measure of the benefit of targeting each vehicle. The benefit is just the difference in a desirable quantity when the vehicle participates in the special strategy versus when the vehicle remains in the normal I/M process.

The problem with ranking vehicles based on the expected benefit of the special strategy is that the calculation of the size of the benefit is based entirely on future quantities. These include the targeting verification ASM pass/fail result, the monthly ASM failure probability over the next two years, the monthly mass emissions of the vehicle over the next two years, repairs made to the vehicle as the result of ASM failures, and any future emissions degradation caused by abrupt failure or gradual degradation of emission control system components on the vehicle. In addition, to calculate the expected benefit of targeting, we would need to know these quantities for both paths: if the vehicle is targeted, and if the vehicle remains in the normal I/M process.

Obviously, there is no way to know these quantities for a given individual vehicle. However, we have found, using the capabilities of the extended ASM failure probabilities that we discussed earlier, that while we cannot know for certain the exact future of a vehicle, it is possible to calculate the probable future quantities that we need to calculate the expected benefits of an individual vehicle participating in a special strategy. Once we have developed the ability to forecast the future probable emissions and the ASM failure probability as a function of time,

we can use this capability to rank vehicles and to evaluate the benefits and costs of different methods for ranking vehicles in different specifically formulated strategies.

Calculation of benefits and costs of different strategies requires information about the effects of the strategies on individual vehicle emissions. However, during the planning phase of field data collection, we found that it was impractical to call-in, direct, exempt, or scrap vehicles in sufficient quantities and at low enough cost to produce the monthly emissions information that would be required to evaluate these special strategies. In addition, we believe that imposing such "pilot" strategies would likely produce answers that would not be representative of the performance of real-world strategies that would be realized after implementation. Accordingly, the approach that we took for calculating benefits, costs, and cost-effectiveness was to simulate the four strategies. We created an I/M simulator based on nine years of California I/M program inspection records and the 2.2-million RSD measurements taken in this pilot project. A description of the I/M simulator is provided in Section 6.2.

6.2 Estimating the Benefits of the Participation of an Individual Vehicle

We have developed a mathematical method for forecasting the three FTP emissions rates, the six ASM mode/pollutant concentrations, and the ASM failure probabilities for almost any individual vehicle in the California I/M fleet. The forecasts are time dependent, which is critical for quantifying emissions reductions and costs in this study. Time is a key variable for making good decisions about the disposition of a vehicle in any specific strategy. In addition, the forecasts can be made for a variety of I/M program configurations, including the use of different strategies. This I/M simulator was necessary for us to calculate the benefits and costs of different special strategies since no vehicles actually participated in a special strategy during the field program. We developed two relationships with these properties.

VID-Alone Relationships[8] – The VID-alone relationships forecast the six ASM mode/pollutant and overall ASM failure probabilities of individual vehicles using only a vehicle's I/M inspection records. The forecasts are time-dependent, which means that the forecasts change as the time since the previous inspection gets longer and as the vehicle ages. These relationships were built on nine years of historical California ASM inspection data from the VID. This dataset contains about 200-million observations that contain information on the effects of vehicle description, age, ASM cutpoints, previous-cycle ASM pass/fail results, and time since the previous I/M certification. No RSD information is required to make forecasts using the VID-alone relationships.

[8] Known as VID History in the implementation report [4].

VID+RSD Relationships[9] – When an RSD measurement on a vehicle is available in addition to VID data, we want to use both types of data to forecast ASM failure probabilities. Accordingly, we built a second set of relationships, the VID+RSD relationships, which use an individual vehicle's RSD measurements in addition to the individual vehicle's I/M inspection records to forecast the six ASM mode/pollutant and overall ASM failure probabilities. The forecasts from these relationships are also time-dependent. These relationships were built on a dataset that is the intersection (see Table 6-2) of the 200-million record historical VID and the 2.2-million RSD observations measured in this pilot study, to predict the failure probability of the 69,629 initial-cycle I/M-station ASM inspections that occurred after the RSD measurements.

Table 6-2. Selection of Data Records for Models that Use RSD as Inputs

Cumulative Attributes	Number of Records
All RSD records	2,231,515
+ Valid RSD measurements	1,456,274
+ Moderate engine load ($5 \leq VSP \leq 25$ kW/Mg)	843,867
+ No duplicate RSD records	827,487
+ Non-Error VIN decodes	486,286
+ Initial-cycle ASM after the RSD	90,574
+ I/M cycle before RSD has been completed	76,982
+ Record produces output from all Fprob models	69,629

We discovered that certain calculus manipulations of the VID-alone and the VID+RSD time-dependent failure probability relationships and statistical relationships that connected ASM emissions concentrations to FTP mass emission rates led to new relationships that could estimate the FTP emissions rates of an individual vehicle as a function of vehicle description, age, previous-cycle ASM pass/fail results, and time since the previous I/M certification. These relationships can be successfully applied whether or not RSD measurements are available. They predict the ASM failure probabilities and the estimated FTP emissions rates for an individual vehicle after completing an I/M inspection cycle. After a vehicle experiences an I/M inspection, the vehicle "relaxes" toward its natural higher-emitting state. These relationships describe the time dependence of this relaxation, which occurs in the absence of any further I/M program activity.

Therefore, to quantify the effects of the I/M program and special strategies, we needed to modify the forecasts. An I/M program causes the ASM failure probabilities and FTP emission rates to change when a vehicle gets an I/M inspection. That's the whole point of the I/M inspection. Of course, we do not know when the next inspection cycle will be because it is in the

[9] Known as VID/RSD + VID History in the implementation report [4].

future. However, through an analysis of the 200-million observation historical VID, we calculated the I/M completion probability, which gives the probability that a vehicle will receive its next-cycle I/M certification in a given month as a function of vehicle age, previous-cycle ASM pass/fail result, and the date of the previous-cycle inspection.

We put together the forecasted time-dependent failure probability, the forecasted FTP emissions rates, and the I/M completion probability in the context of an I/M program (with or without special strategies) using probability theory to produce forecasted time-dependent FTP emission rates and ASM failure probabilities for the vehicle as if it were participating in the I/M program or strategy. Using the monthly vehicle miles traveled for the vehicle, we can then forecast the monthly FTP-basis mass emissions for an individual vehicle over the future twenty-four months.

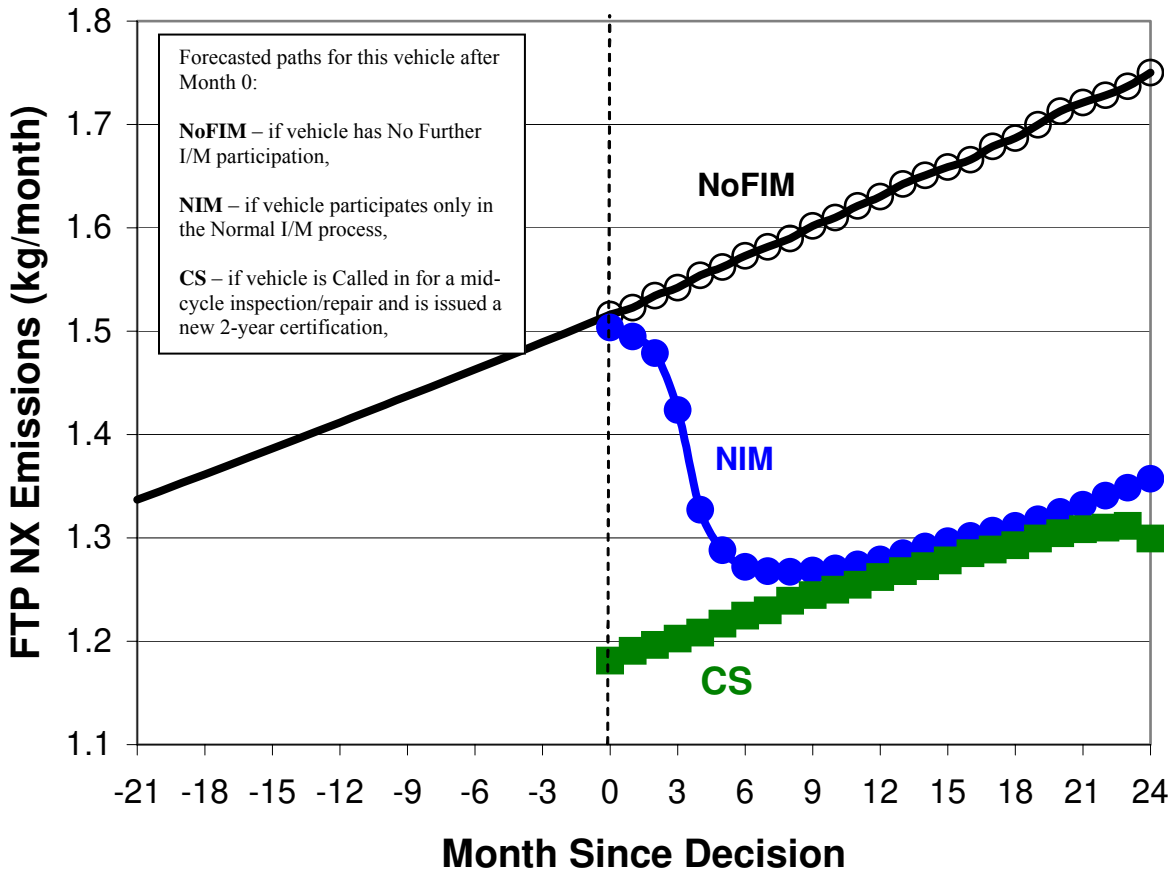
Since the forecasts are a function of time and I/M program configuration, we can forecast the two-year FTP mass emissions for a vehicle for different strategies. The difference in mass emissions calculated for an individual vehicle, if it participates in a strategy and if it does not, reveals the size of the emissions reduction benefit that would be realized by having the vehicle participate in a particular strategy. The I/M simulator can make the calculations that forecast the emissions benefits of an individual vehicle's participation in a special strategy.

An example will help demonstrate the I/M simulator. A particular 1988 Ford Taurus with a 3.0 liter engine received its previous-cycle initial test on February 15, 2003 in which the vehicle failed the ASM2525 NO and passed the other five mode/pollutant tests. The vehicle was repaired and four days later it passed all six ASM mode/pollutant tests and was certified. Twenty-one months later on November 22, 2004, the vehicle received an on-road RSD measurement in the California RSD pilot study. Based on odometer readings recorded in the VID for consecutive I/M inspection cycles, the vehicle is known to drive about 1,000 miles per month. What would be the estimated two-year FTP mass emissions benefit of calling-in the vehicle for an early I/M-station ASM emissions inspection and possible repair? Because of the RSD measurement, the vehicle has come to our attention on November 22, 2004. We call this date the **Decision Point** since we must decide whether to call-in the vehicle or to let it remain in the normal I/M process.

Figure 6-1 shows the I/M simulator forecasts for this vehicle's estimated FTP NOx emissions for three situations: if the vehicle would no longer participate in the I/M program (NoFIM), if the vehicle participates in the I/M program without any calling-in intervention (NIM), and if the vehicle is called in immediately for a regular I/M station ASM emissions test

and possible repair (CS). The vertical dashed line denotes the month of the RSD. Months to the left of that line are in the past. The line from -21 to 0 months shows that in past the emissions have likely been increasing. The vehicle is due for its next I/M inspection in Month 4. The NIM curve shows that the emissions are expected to drop because of the inspection process around Month 4 and then will later begin to increase again as the vehicle ages and as the benefits of a repair degrade. If the vehicle does not come in, the emissions will follow the NoFIM line. The size of the area between the NoFIM line and the NIM curve, -7.5 kg NOx, is the biennial benefit of the I/M program for this vehicle. The size of the area between the NIM curve and the CS curve, -1.8 kg NOx, is the biennial benefit of the calling-in strategy for this vehicle.

Figure 6-1. Demonstration of FTP Mass Emissions Forecasting


Forecasted paths for this vehicle after Month 0:
NoFIM – if vehicle has No Further I/M participation,
NIM – if vehicle participates only in the Normal I/M process,
CS – if vehicle is Called in for a mid-cycle inspection/repair and is issued a new 2-year certification,
NoFIM
NIM
CS
FTP NX Emissions (kg/month)
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
-21 -18 -15 -12 -9 -6 -3 0 3 6 9 12 15 18 21 24
Month Since Decision

The calculated value for forecasted FTP mass emissions for a specific individual vehicle is an estimated value calculated using the statistical techniques developed in this study. The calculated value for a specific vehicle is an estimate because it carries with it a collection of uncertainties including emissions modeling uncertainty, vehicle emissions variability, individual

vehicle emissions idiosyncrasies, and emissions measurement variability. Accordingly, the calculated value is our best estimate of the expected FTP emissions of the vehicle and can be thought of as the average for all vehicles with the same description, IM cutpoints, age, and IM history as the vehicle in question. Clearly, the actual FTP emissions for a specific vehicle will deviate from the average value of all such similar vehicles. However, the concept is that the sum of the expected values for a large set of vehicles will be close to the sum of the actual values for those vehicles. This makes the estimated values useful because intervention activities will be applied to a large set of vehicles in the I/M fleet. From the perspective of the I/M program, the benefits of an intervention activity estimated using estimated values will approximate the real benefits achieved. The use of time-dependent, estimated emissions values to calculate the estimated emissions benefit of calling in a vehicle is conceptually no different than the current practice of using standard, non-time-dependent ASM failure probabilities (Fprobs) to direct vehicles. The forecasted FTP mass emissions are just more useful because they are time-dependent, are specific to the VID history of the vehicle, and provide emissions estimates.

RSD-Alone Relationship[10] – We also developed a third relationship for the case where only RSD measurements were available. Like the VID+RSD relationship, it was built on the 69,629 observations described in Table 6-2. This relationship is needed so that the analysis can determine the incremental benefits of a strategy when using RSD measurements but without any information about where the vehicle is with respect to its I/M activities. Not having VID information on a vehicle turned out to be a disadvantage. The RSD-alone relationship can predict, but cannot forecast, the six ASM mode/pollutant and overall ASM failure probabilities. These predicted ASM failure probabilities are <u>not</u> time-dependent, but are instead constant. This means they cannot reflect the effects of vehicle aging or the effects of elapsed time since the previous inspection. Also, because they have neither time dependence nor ASM cutpoint functionality, they cannot be combined with I/M completion probabilities (as VID-alone and VID+RSD can be) to produce time-dependent emissions trends like those shown in Figure 6-1. Accordingly, the RSD-alone relationships cannot be used to calculate the mass emissions benefits of an individual vehicle's participation in a special strategy.

Given the above list of all of the things that RSD-alone cannot do, it might seem that RSD-alone is of very limited value. This is not the case. Individual vehicles can still be ranked based on the predicted overall ASM failure probability as calculated by the RSD-alone relationship. This is an important capability for RSD users to have. Traditionally, researchers applied arbitrary RSD "cutpoints" to the RSD HC, CO, and NO measurements to determine if

[10] Known as RSD + Nothing in the implementation report [4].

the vehicle was an RSD passer or failer. However, using cutpoints and measured emissions on three pollutants cannot be used directly to rank vehicles, since ranking can be done only on a single quantity. Our new RSD-alone relationship, which combines the ASM failure probabilities derived from each of the three RSD pollutant measurements, is a single quantity. When vehicles are ranked by RSD-alone, they are being ranked in the order of their ASM failure probabilities.

6.3 Methods of Ranking Individual Vehicles for a Strategy

The I/M simulator, which was described above, provides a way to calculate the benefits for an individual vehicle's participation in a special strategy. But what is the best way to prioritize or rank vehicles for targeting by a strategy? What criterion should be used? The ranking methods that produce the largest improvement in quantities that are important to I/M will be those that are favored. To help answer this question, we evaluated three basic vehicle ranking methods.

ASM Failure Probability at Decision Point (FprobDP) – The simplest ranking method is to use the ASM failure probability at the time of the decision to include the vehicle in a strategy or not, that is, at the Decision Point. This method selects vehicles that are most likely to fail an immediate I/M-station ASM test. This is the method that has traditionally been used to select vehicles for Directing and Scrapping. It can be used for Calling-In, and if vehicles are reverse-ranked, it can be used for Exempting. The problem with using ASM failure probability at decision point is that it ranks vehicles only on the ASM failure probability at a single point in time even though we know that a vehicle has emissions over the long period of time between I/M inspections. It completely ignores the time aspects of the interaction between the vehicle and the I/M program, and it completely ignores the vehicle miles traveled by the vehicle. For example, if a vehicle that is being considered for Calling-In is expected to begin its next I/M cycle in only one month, the vehicle will soon be tested by the regular I/M program anyhow. If the vehicle's miles traveled are low, then the vehicle is not a large risk to the airshed unless its FTP emission rate is quite high.

Change in biennial Failed Miles Driven (ΔFMD) – This basic ranking variable makes up for the deficiencies of an ASM failure probability at the decision point. Failed Miles Driven integrates the time-dependent ASM failure probabilities over two years and accounts for vehicle miles traveled. The difference in failed miles driven (ΔFMD) for a vehicle proceeding through the normal I/M path, versus the same vehicle taking a Directing, Exempting, or Calling-In path, can be used to estimate the benefit that would likely be realized by taking the alternate path. By ranking vehicles by the size of their forecasted ΔFMD, the vehicles with the highest potential

benefits over a two-year period can be selected for special strategies. While the goal of the I/M program is to reduce total fleet emissions, the means by which the I/M program approaches the problem is by trying to ensure that all vehicles are in an ASM-passing status at all times. Of course, Failed Miles Driven is related to the emissions of the vehicle since vehicles with higher emissions will tend to drive more miles in an ASM-failing status. By selecting vehicles with large forecasted ΔFMDs, vehicles that both emit more than they should and drive more over a biennium are better identified in comparison with selecting vehicles simply on the ASM failure probability at the decision point.

Change in biennial FTP mass emissions per dollar of vehicle value (ΔFTP/$) – I/M program designs recognize that simply minimizing the total emissions is not a practical goal because the logical conclusion of that goal is the crushing of all vehicles. On the other hand, crushing vehicles is the stated goal of Scrapping. Accordingly, the ranking variable for selection of vehicles for Scrapping is based on the forecasted change in estimated FTP mass emissions (ΔFTP) over two years if the vehicle were scrapped versus if it remained in the normal I/M process. However, the ranking variable is not exactly the ΔFTP. Instead, the ranking variable is ΔFTP divided by the value of the vehicle in dollars. By ranking vehicles by ΔFTP/$, the state of California can target those vehicles for scrappage that will provide the largest decrease in estimated FTP emissions for the limited budget that the state has to spend on purchasing scrappage vehicles.

For each strategy and for each of the failure probability relationships (VID-alone, RSD-alone, or VID+RSD), which are based on different types of vehicle information, we ranked vehicles by giving highest priority to those that were likely to have the largest benefits consistent with the working objective of the I/M program. The working objective of the I/M program is that all vehicles on the road should be in an ASM-passing status at all times during the two-year period.

We have chosen ranking methods for each strategy that are consistent with the working objective of the I/M program and the capabilities of the available vehicle information. The ranking methods that we have used in this analysis are shown in Table 6-3. The goals for Calling-In and Directing are to maximize a reduction in Failed Miles Driven over the two-year period after the Decision Point. The goal of Exempting is to minimize the increase in Failed Miles Driven over the two-year period. The goal of Scrapping is to reduce the fleet FTP mass emissions over the two-year period by as much as the vehicle purchase budget will allow. If vehicles are ranked in this manner, regardless of how far vehicle targeting penetrates the ranking, the largest benefit for the fleet will be achieved.

As Table 6-3 indicates, these goals can be realized with the VID-alone and VID+RSD relationships. However, as described earlier, the RSD-alone relationship does not have the capability to calculate the change in failed miles driven or the change in estimated FTP mass emissions for a vehicle's participation in a strategy. Accordingly, the next best method for vehicle ranking for RSD-alone is to rank by the ASM failure probability at the decision point.

Table 6-3. Ranking Criterion Used for Strategy/Information Combinations

	Individual Vehicle Ranking Method		
Strategy	**VID-alone**	**RSD-alone**	**VID + RSD**
Calling-In	ΔFMD	FprobDP	ΔFMD
Directing	ΔFMD	FprobDP	ΔFMD
Exempting	ΔFMD	FprobDP	ΔFMD
Scrapping	ΔFTP/$	FprobDP	ΔFTP/$

As we will see later, ranking vehicles by ASM failure probability at the decision point as calculated by RSD-alone will provide substantial fleet emissions benefits. However, the benefits are not nearly as large as those provided by VID-alone and by VID+RSD. We believe the reason for this is that VID-alone and VID+RSD take into account the point the vehicle is at in its I/M cycle, which is a reason that centers on timing. Thus, it appears that knowing the timing of a vehicle's RSD measurement with respect to the vehicle's I/M cycle is an important piece of information when considering the effectiveness of adding an RSD component to an I/M program.

As an aside, we have been asked what we mean by high emitters and low emitters per se. The reader may have noticed that we do not talk about high emitters and low emitters. The reason is that in this study we are taking a different approach – a probabilistic approach. When a decision needs to be made to either target an individual vehicle for a special strategy or to let it remain in the normal I/M process, it is based on the probability of the vehicle failing a future ASM test. Whether or not that vehicle is an actual ASM high emitter is not certain. As we will see in Section 9, this is not known conclusively even if RSD measurements on the vehicle have been taken.

Different investigators casually speak about high emitters without defining the term. For example, a high emitter could be defined as:

- A vehicle that has emissions concentrations that are higher than current technology vehicles,
- A vehicle whose tailpipe concentrations exceed at least one of the its I/M cutpoints at the I/M inspection, or

- A vehicle whose tailpipe concentrations exceed at least one of its I/M cutpoints at any point during a two-year period.

In this study, we are trying to find the high emitters by selecting vehicles that drive a large number of miles over the biennial period and that simultaneously have generally high ASM failure probabilities over the biennial period. When these two concepts of "miles driven" and "failure probability" are put together, we arrive at the notion of identifying vehicles that are more likely to be driving a large number of miles in an ASM-failing status during a two-year period, that is, Failed Miles Driven. We think that this approach is consistent with the goal of the I/M program and with the goal of reducing emissions to the airshed while acknowledging the variety of emission control technologies in the fleet.

Accordingly, for this study and for Calling-In, Directing, and Exempting, we would define high emitters as those vehicles that drive a large number of miles in an ASM-failing status over a two-year period and low emitters as vehicles that drive few or no miles in an ASM-failing status over a two-year period. For Scrapping, we would define high emitters as those vehicles that are more likely to emit a large mass of emissions over a two-year period and low emitters as vehicles that emit a small mass of emissions over a two-year period.

6.4 Estimating Fleet Benefits of a Strategy

The previous section described the methods used to rank vehicles for each special strategy. Once the vehicles are ranked, the next step is to evaluate the ranking in terms of the benefits and costs to the I/M program.

The benefits and costs for a ranking depend on the vehicles that are targeted and on those that participate in the strategy. Vehicles that are not targeted do not contribute to the benefits because those vehicles remain on the normal I/M process path. If no vehicles are targeted, there will be no benefits. Because the vehicles have been ranked from those that would provide the largest benefits to those that would provide the smallest benefits, vehicle targeting starts from the top of the ranking and ends when the desired penetration or targeting percentage of the vehicles in the ranking has been reached. As a group, the targeted vehicles would provide the largest benefit to the I/M program for that strategy and that vehicle ranking method.

The fleet benefits for the strategy at the penetration rate used would simply be the sum of the benefits for the individual vehicles that are targeted. Therefore, for the 69,629-observation dataset, the individual vehicle benefits of the targeted vehicles need to be summed. Now, we have an obstacle, because for no vehicles in the study do we have measured emissions and

failure probabilities for vehicles for each of the 24 months after the RSD measurements were obtained. That is, there are no measured benefits to sum.

How then do we evaluate the performance of these two different rankings? Here is the solution. As a surrogate for these measurements, we use the forecasted ASM failure probabilities and estimated FTP mass emissions using the best forecasting model that we have developed – the VID+RSD relationship. To consistently use the same benefits for each individual vehicle, we always use VID+RSD to calculate the forecasted benefits regardless of the models that were used to rank the vehicles for the strategy. Accordingly, we have a case here where we are using one model to evaluate the performances of other, competing models. This introduces a bias in the results of the evaluation. However, because RSD information is in the evaluation model, the bias will always be in favor of models that contain RSD information. If under these circumstances, the RSD information is found to be not cost-effective then in the real-world situation, RSD will be even less cost-effective.

Additionally, we need to make an assumption about the participation of targeted vehicles in the strategy. Simply because a vehicle is targeted does not mean that the vehicle will participate. Participation rates will depend on the procedural and enforcement details of each strategy. Because we have not quantified actual participation rates for the strategies in this study, we have assumed that participation rates are 100% for all strategies. Again, if under these circumstances, a strategy is found to be not cost-effective then in the real-world situation the strategy will be even less cost-effective.

In the case of Directing, it should be possible to achieve near 100% participation since I/M procedures can be developed that would disallow inspections of directed vehicles at average-performing I/M stations. Exempting participation rates will be less than 100% because vehicle owners may simply forget to respond to a mailing that offers them Exempting. Calling-In participation rates will probably be substantially lower than 100% since the strategy requests owners to come in off-cycle for the call-in ASM inspection. Enforcement action may be necessary. Finally, for Scrapping, not only will owners need to respond to a mailing and come in off-cycle for a scrappage ASM, if the vehicle fails they will also need to accept an offer to purchase their vehicle before they can be considered a participant in Scrapping.

To evaluate an individual vehicle ranking method for a strategy and the ability of RSD measurements to improve the strategy, we needed to consider a number of different fleet quantities. Value is ultimately determined by considering costs and effectiveness, however, we also considered some other quantities that are important to an I/M program. Each of the

following fleet quantities is presented in the cost-benefit analysis results for each strategy in Section 7:

- ASM Fail Rate at Decision Point (%);
- ΔFailed Miles Driven (miles/2years);
- Total ΔFTP HC + NOx (tons/2years);
- Total Costs ($/2years); and
- Cost-Effectiveness ($/ton HC + NOx).

ASM Fail Rate at Decision Point – This value is the fraction of vehicles that would fail an I/M station ASM test on the day that the decision was made to select or to not select a vehicle for a strategy. We do not regard the decrease in ASM Fail Rate at Decision Point as a benefit because it occurs at just a single point in time. The decrease in fail rate is a consequence of repair; however, as the benefits of repair degrade between I/M cycles, the ASM fail rate increases. The benefits of a repair accrue over the entire biennial period. Nevertheless, ASM Fail Rate at Decision Point is an important quantity because, without a failing result for Directing, Calling-In, and Scrapping or a passing result for Exempting, the benefits of the strategy will not be realized. The ASM Fail Rate at Decision Point does not reflect the level of failure for a vehicle over a two-year period. This is the reason that we developed the idea of Failed Miles Driven over the two-year period.

ΔFailed Miles Driven – ΔFailed Miles Driven is the calculated change in estimated Failed Miles Driven for the fleet over two years that would result from the use of a special strategy. We regard a decrease in Failed Miles Driven as a benefit to the I/M program. Failed Miles Driven extends the notion of ASM Fail Rate at Decision Point to an entire biennial period because the ASM failure probability changes with the vehicle's participation in the I/M program, with the time elapsed since the vehicle's previous Smog Check inspection as a consequence of emission control system wear and failure, and with vehicle aging. In addition, Failed Miles Driven takes into account the level of usage of the vehicle. Vehicles that are not driven a large number of miles are a lower risk to the I/M program than vehicles that are driven many miles per month. Because the approach of the I/M program is to identify vehicles that fail the ASM emissions test, reductions in Failed Miles Driven are a benefit to the I/M program just as reductions in tons of FTP HC + NOx emissions are a benefit to the airshed.

Total Δ FTP HC + NOx – ΔFTP is the calculated change in the mass emissions of the fleet over two years that would result from the use of a special strategy. We regard a decrease in FTP mass emissions as a benefit to the I/M program. Just as for Failed Miles Driven, the mass emissions of a vehicle change with the vehicle's participation in the I/M program, with the time elapsed since the vehicle's previous Smog Check inspection as a consequence of emission control system wear and failure, with vehicle aging, and with the level of usage of the vehicle. The acronym "FTP" signifies that the mass emissions are on an FTP basis. The estimated FTP mass emissions for a given month for an individual vehicle is the estimated FTP emission rate (g/mile) for the month times the number of miles that the vehicle drives in the month. We use the Δ FTP HC + NOx over a two year period for the I/M fleet as a measure of the effectiveness of a special I/M strategy. The I/M simulator has the capability of calculating time-dependent estimated FTP mass emissions for HC, CO, and NOx for individual vehicles in the normal I/M process or in the normal I/M process supplemented by a strategy.

Total Costs – The cost for each strategy is built up from estimates of costs for central office, RSD measurements, notices, inspections, certificates, repairs, purchase of scrappage vehicles, and model update and maintenance. The I/M simulator provides the information that is needed to calculate these costs for a given strategy and for any given level of vehicle targeting within a strategy. Costs will be discussed in detail in Section 6.5.

Cost-Effectiveness – We defined the cost-effectiveness of a strategy as the total cost to run a strategy over a two-year period divided by the reduction in tons of FTP HC + NOx over the same two year period.

When we estimate the value of a strategy or the value of adding RSD to a strategy, we need to consider all five of the above quantities. Only ΔFailed Miles Driven and total ΔFTP HC + NOx are benefits. Traditionally, strategies have gone after maximizing ASM Fail Rate at Decision Point. However, we found that this approach causes the accrued benefits of the I/M program over a biennium as measured by ΔFailed Miles Driven and Total ΔFTP HC+NOx to be smaller than they would otherwise be.

As a result of investigating the benefits of special strategies, we found that trade-offs exist among important I/M program performance measures. Since the I/M simulator can quantify these trade-offs, as an aside, we will examine some of them.

When individual vehicles are ranked for a given strategy, the ranking must focus on a single quantity that is being optimized. However, in an I/M program, there are several quantities

that are of interest to program administrators. We believe that there are at least five quantities that administrators should be interested in:

- ASM Fail Rate at Decision Point,
- Failed Miles Driven,
- FTP HC,
- FTP CO, and
- FTP NOx.

When vehicle rankings focus on one of these five quantities, the other four are not improved to the maximum extent possible. Thus, there are trade-offs among the five quantities. It is important that I/M program administrators recognize these trade-offs and make a conscious decision about which of the quantities they would like to use as the focus of special strategies.

As an example, we provide Table 6-4, which demonstrates the trade-offs between ranking vehicles by ASM failure probability at decision point and probable ΔFailed Miles Driven for three different strategies. Consider the first strategy in the table, which is Directing. If we rank individual vehicles by ASM failure probability at Decision Point for 40% fleet targeting, we see that the ΔFailed Miles Driven and ΔFTP emissions are reduced by a specific amount. The ASM Fail Rate at Decision Point is 21.8%. On the other hand, if we rank the vehicles by their probable ΔFailed Miles Driven, we get a different vehicle ranking and therefore different reductions in ΔFailed Miles Driven, ΔFTP emissions, and a different ASM Fail Rate at Decision Point. When vehicles are ranked by ASM failure probability at the decision point, the ASM Fail Rate at Decision Point is the highest that it can be of any possible individual vehicle rankings. Therefore, when we rank the vehicles by a probable ΔFailed Miles Driven, the ASM Fail Rate at Decision Point decreases. The table shows it decreases to 20.1%. In a similar manner, when we rank by a probable ΔFailed Miles Driven, the observed ΔFailed Miles Driven is -17.5%. No other individual vehicle ranking for Directing will produce larger ΔFailed Miles Driven than this ranking.

In the table, we show the more attractive values for the five quantities in bold font. In general, we see that when individual vehicles are ranked by the probable ΔFailed Miles Driven, the observed ΔFailed Miles Driven and the FTP emissions drop by larger amounts than when individual vehicles are ranked by ASM failure probability at decision point. However, the trade-off is a lower ASM Fail Rate at Decision Point.

Table 6-4. Example of Trade-Offs

Strategy	Individual Vehicle Ranking Method	Percent Fleet Targeted (%)	Fleet ΔFailed Miles Driven (ΔFMD) over 2 years (% of I/M Fleet FMD)	Fleet ΔFTP Emissions over 2 years (% of I/M Fleet FTP Emissions)			ASM Fail Rate at Decision Point (%)
				HC	CO	NOx	
Directing		0%	0.0	0.0	0.0	0.0	100.0%
	Failure Probability at Decision Point	40%	-16.5	-8.0	-5.3	-4.2	**21.8%**
	Probable ΔFailed Miles Driven	40%	**-17.5**	**-8.6**	**-5.6**	**-4.8**	20.1%
		100%	-20.2	-11.3	-7.6	-7.3	10.2%
Exempting		0%	0.0	0.0	0.0	0.0	0.0%
	Failure Probability at Decision Point	20%	0.38	0.82	0.57	0.86	**0.6%**
	Probable ΔFailed Miles Driven	20%	**0.10**	**0.34**	**0.29**	**0.45**	2.0%
		100%	20.2	11.3	7.6	7.3	10.2%
Calling-In No-Sticker		0%	0.0	0.0	0.0	0.0	100.0%
	Failure Probability at Decision Point	5%	-2.4	-0.96	-0.56	-0.42	**51.8%**
	Probable ΔFailed Miles Driven	5%	**-3.6**	**-1.21**	**-0.65**	**-0.64**	40.0%
		100%	-8.4	-4.2	-2.9	-2.8	10.2%

Individual vehicles could also be ranked by specific types of FTP emissions or combinations of FTP emissions. For example, if certain areas of California had an ozone problem that was determined to be NOx limited, then vehicles could be ranked for the strategies using the probable decrease in FTP NOx emissions. In this study, we did not investigate rankings based on the forecasted ΔFTP emissions of individual types of pollutants. Nevertheless, the I/M simulator is capable of producing these rankings. Thus, rankings based on ΔFTP emissions could be examined to determine the trade-offs that could be expected and the resulting values for ΔFailed Miles Driven and ASM Fail Rate at Decision Point.

Basically, it all comes down to I/M program administrators deciding what quantity is most important for their I/M program in a particular area. Is it ASM Fail Rate at Decision Point, which is a one point in time value, or would a better goal be to maximize the reduction in failed miles driven or the reduction in mass emissions to the airshed?

6.5 Estimates of Fleet Costs of a Strategy

When the existing I/M program is supplemented with special strategies, the total cost of the I/M program changes. In some cases, the rationale for implementing a special strategy is to reduce the total cost of the I/M program while keeping it as effective as it had been or even improving the overall effectiveness of the program. We estimated the changes in costs for each of the special strategies as a function of the scope and attributes of the strategies. The time-dependent ASM failure rates calculated by the I/M simulator made the calculation of the various types of special strategy costs possible.

The incremental cost to the existing I/M program produced by the special strategies are made up of the following categories:

- RSD measurement costs;
- Central office costs;
- Scrappage vehicle purchase costs;
- Vehicle repair costs;
- Vehicle owner notification costs;
- Inspection certificate costs;
- Inspection costs; and

- Model update and maintenance costs.

In the discussion below, each of these costs is described and the special strategies which influence the costs are pointed out.

RSD data collection costs – To estimate the RSD data collection costs, it was necessary to make some assumptions about how RSD data collection would be implemented. For the purposes of costing, we assumed that all RSD measurements would be collected by manned RSD units located only in the five largest AQMDs. We assumed that the RSD measurement effort was largely accepted by the public and that drivers did not try to avoid RSD sites or try to invalidate the measurements. In addition, we assumed that the restrictions that CalTrans placed upon our RSD measurement teams would be lifted so that RSD measurements could take place during rush hour traffic. Finally, we assumed that there would be no costs for enforcement, for example, to fight legal challenges on the validity of RSD measurements.

RSD data collection vendors typically charge clients for RSD data collection based on the number of valid, DMV-matched RSD measurements provided. The vendor ensures that the RSD measurement is valid according to the RSD instrument software, and they match the RSD reading to a vehicle registration record using the vehicle's license plate information, which is captured at the time of the RSD measurement. The vendors do not consider the operating mode of the vehicle when counting RSD observations to determine their fees for measurement or when determining coverage of the fleet. For their purposes, vehicles can be operating at any VSP[11]. Therefore, we refer to the RSD vendor's definition of coverage of a fleet as the any-VSP RSD coverage. Any-VSP RSD coverage is discussed more in Section 9.4 and is contrasted with usable-VSP RSD coverage.

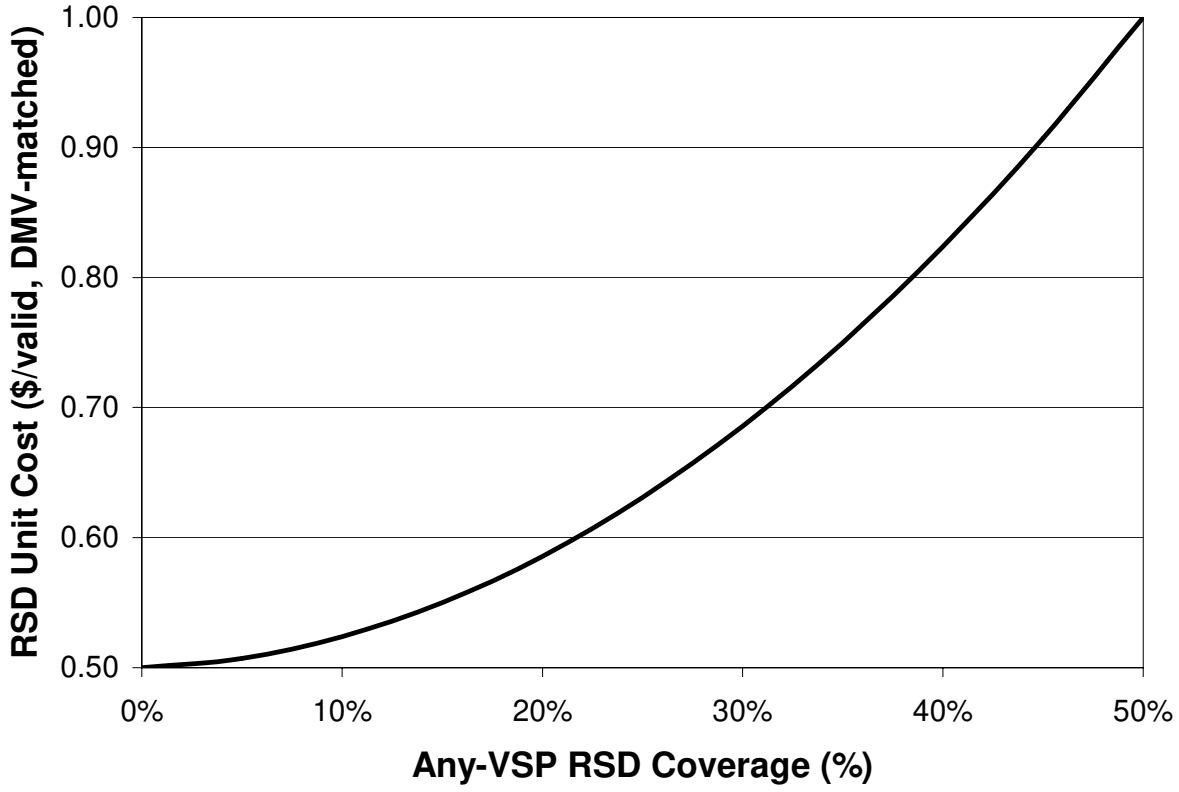
The unit cost of a valid, DMV-matched RSD reading provided by the vendor is dependent on the RSD fleet coverage because getting RSD measurements on the increasingly difficult-to-find unique vehicles means that RSD equipment must be set up at more and more, less-than-ideal RSD sites. Figure 6-2 shows the RSD unit price as a function of the RSD coverage of the geographical area. The coverage is measured by the percent of the fleet that gets at least one valid, DMV-matched RSD reading. The costs in the figure were developed from the real-world experience of other jurisdictions that have RSD programs.

[11] VSP is an acronym for vehicle specific power, a measure of the load on the engine and which can be estimated from the vehicle's speed and acceleration and the road grade.

Using the estimated unit costs from Figure 6-2 and estimates of the number of unique I/M and non-I/M vehicles with valid, DMV-matched RSD readings for different sized RSD programs we were able to calculate the total annual RSD data collection costs shown in Table 6-5.

The table shows that annually the large RSD program costs almost $26 million to obtain 4 million RSD measurements that could be used to select vehicles for special strategies. Thus, the average cost of RSD data collection for each usable RSD measurement is $6.41. Even at this price, this large RSD program provides a usable-VSP RSD coverage of only 30.28% of the statewide I/M fleet. The data collection for the smaller size RSD programs is less expensive overall and less expensive per I/M vehicle with a usable RSD reading; however, even smaller portions of the I/M fleet are covered.

Figure 6-2. Estimated RSD Unit Cost for Contracted, Manned Measurements



C:/MyDocuments/CA RSD Pilot Decision report/Implementation Report/RSD unit price function.xls

Table 6-5. Comparison of RSD Programs of Different Size

A	B	C	D	E	F	G	H	I	J
	Desired		**Required**			**Achieved**			
RSD Program Size	**Any-VSP RSD Coverage[12] (% of California I/M and non-I/M vehicles driving in the 5 largest AQMDs)**	**Number of Unique I/M and non-I/M Vehicles with Valid, DMV-Matched RSD Readings[13] (based on 18,982,879 California I/M and non-I/M vehicles driving in the 5 largest AQMDs[17])**	**Number of Valid, DMV-Matched RSD Readings[14]**	**RSD Unit Cost (approx.) ($/ valid, DMV-matched RSD reading)**	**Annual RSD Data Collection Cost ($)**	**Number of Unique I/M vehicles Driving in the 5 Largest AQMDs that have at least one In-Range-VSP, Valid, DMV-Matched RSD Reading[15]**	**Usable-VSP RSD Coverage[16] of I/M Vehicles Driving in the 5 Largest AQMDs (% of the 11,358,066 California I/M vehicles driving in the 5 largest AQMDs)**	**Usable-VSP RSD Coverage of I/M Vehicles Driving in the Entire State (% of the 13,388,069 California I/M vehicles driving in the State)**	**Effective RSD Cost ($/ IM vehicle with a usable RSD reading)**
Large	50%	9,491,440	25,975,057	$1.00	$25,973,758	4,053,388	39.7%	30.28%	$6.41
Medium	30%	5,694,864	11,026,614	$0.69	$7,560,751	2,157,461	22.2%	16.11%	$3.50
Small	10%	1,898,288	2,598,317	$0.52	$1,360,993	625,831	6.7%	4.67%	$2.17

C:/MyDocuments/CA RSD Pilot Decision Report/Implementation Report/Usable RSD Data Costs.xls

[12] Fraction of fleet vehicles with at least one RSD measurement obtained under any vehicle operating condition. See Section 9.4.
[13] From Table 3-1b of Reference 4 and based on the EMFAC run results shown in Table N-1 of Appendix N of Reference 3.
[14] From Table 3-1b of Reference 4 and based on the EMFAC run results shown in Table N-1 of Appendix N of Reference 3.
[15] From Table 3-1b of Reference 4 and based on the EMFAC run results shown in Table N-1 of Appendix N of Reference 3.
[16] Fraction of fleet vehicles with at least one RSD measurement obtained under moderate engine load (VSP = 5 to 25 kW/Mg). See Section 9.4.
[17] From Table 3-1a of Reference 4 and based on the EMFAC run results shown in Table N-1 of Appendix N of Reference 3.

Central office costs –We developed functions to estimate central office costs that smoothly modify the cost according to the characteristics of the special strategy program. The resulting functions can calculate costs for a small central office serving a small piece of the state all the way up to a full size office that would cover the entire state. To calculate the central office costs, we made a few assumptions. First, the central office was assumed to be at a single location and housed at an existing state agency. The central office would be at one location regardless of the geographical scope of the fleet of vehicles that is covered by the central office. We did not assume the presence of any branch offices for separate AQMDs.

The job of the central office is to receive weekly data updates, including DMV registrations, VID records, valid DMV-matched RSD data (if RSD data is used), and records of past notices sent to owners, and in the cases of Calling-In and Scrapping, records of subsequent action by the owner. If RSD data collection were used for special strategies, the central office would hire an RSD contractor to provide RSD data and its associated information. However, the cost of the RSD data collection is estimated separately.

The main job of the central office is to create weekly lists of targeted vehicles for the special strategies. The central office would make the list of targeted vehicles by selecting them from the list of all vehicles ranked by the expected benefits of selecting each eligible vehicle. Directing and Exempting would apply only to vehicles that are soon due for an I/M inspection. Calling-In and Scrapping targeted vehicles would be eligible as long as the individual vehicle had not been targeted recently. Ranking of vehicles for targeting would be accomplished by running computer programs like those developed in this project to forecast the benefits of selecting individual vehicles for specific strategies. This is true even when RSD data alone is used because the ranking programs that we have built for this study perform better, that is, they provide greater emission reductions than those provided by using simple RSD cutpoints.

Table 6-6 shows the capital costs for the central office, which are split into three categories. The first item pays for programming changes and form changes for the Department of Motor Vehicles information. This is a one-time expense and would occur only if a Calling-In program were used. A one-time expense would also be incurred if a small central office or a statewide central office would be set up. The second capital expense is for the central office computer equipment. We have estimated this cost at $20,000 for a server plus $2,000 for each employee at the central office. The third capital cost is for the central office supplies and equipment and is directly proportional to the number of employees at the central office.

Table 6-6. Central Office Costs for the Statewide Program for Calling-In, Directing, Exempting, and Scrapping

Full-Fleet Ranking Method Description			VID/RSD + VID History
Strategies?			D X S C
Size of Program (Statewide=1)			1
% Sample Fleet Penetration for Calling-In			5%
With RSD [Yes(1) or No(0)]			1
Percent of Statewide I/M Vehicles Selectable by the Selection Method (%)			100%
Capital Costs			
DMV for Programming, form changes, etc. (One-time Fee for Calling-In Program)			$500,000
Central Office Computer Equipment ($20K for server + $2K per person)			$97,000
Other Capital Costs - central office supplies and equipment			$103,777
Annual O&M Costs			
Amortized capital costs for DMV for Programming, etc. (10yrs @10%)			**$81,373**
Amortized capital costs for computer equipment (5yrs @10%)			**$25,588**
Amortized capital costs for office supplies/equipment (10yrs @10%)			**$16,889**
Labor for Central Office			
Position	Annual Salary @ 40hrs/wk		
Program Administrator	$90,970	1.00	$90,970
Program Manager	$70,754	3.00	$212,262
Engineer /Data Analyst/Programmer	$70,754	5.00	$353,770
Attorney	$63,000	3.00	$189,000
Public Information/Communication	$30,323	20.00	$606,460
Administrative Assistant	$48,000	1.00	$48,000
Receptionist	$30,323	1.00	$30,323
Clerical and Secretarial Staff	$30,323	4.50	$136,454
Salary * Person-Years		38.5	$1,667,239
Overhead and Fringe (100%)			$1,667,239
Equipment maintenance (@20%)			$20,755
Supplies (@10% of Maintenance)			$2,076
Total Labor for Central Office, fully burdened			**$3,357,308**
Misc. Recurring Costs, Central Office			
Operating supplies ($250/person-yr)			$9,625
Travel ($250/person-yr)			$9,625
Hiring and training costs			$18,434
Total for misc. recurring costs at central office			**$37,684**
Other Contract Support (2% of program expenses)			**$70,377**
Total Annual CENTRAL OFFICE O&M Costs (including capital recovery)			**$3,589,219**

D = Directing, X = Exempting, C = Calling-In, S = Scrapping
/proj1/DecisionModel/Report/IM_Strategy_Evaluator_071117.xls

The annual operating and maintenance costs have several categories. The first three shown in Table 6-6 are the amortized capital costs. The largest expenses for operating the central office are the labor costs. The table uses eight different groups of positions with annual salaries. The table shows the sum of the salaries and benefits for personnel, and the costs for equipment maintenance, and supplies. This produces a total labor cost for the central office that is fully burdened. The table also shows miscellaneous recurring costs for central office for operating supplies, travel, and hiring and training costs.

The size of the staff for central office is determined by four variables: the number of I/M vehicles served by the central office, the fraction of the I/M fleet that is targeted for Calling-In, whether RSD data is being used to help select targeted vehicles, and the percent of statewide I/M vehicles eligible for the selection method. In Table 6-6, we show one example that estimates the central office cost for the four-strategy package which includes Directing, Exempting, Scrapping, and Calling-In when VID history and RSD are used together to select vehicles for targeting. The size of the program is statewide. The Calling-In strategy uses a 5% sample fleet penetration, RSD data is available and is being used to help select vehicles, and because VID history information is being used to select vehicles, essentially 100% of the statewide I/M vehicles are eligible for selection.

Scrappage vehicle purchase cost – For the Scrapping strategy, the state buys vehicles and destroys them as a means of eliminating the emissions of those vehicles from the inventory. Of the four special strategies evaluated in this study, Scrapping is the only strategy in which vehicles are purchased. Therefore, the purchase cost of these vehicles is a cost only for Scrapping, and not for Directing, Exempting, or Calling-In. In recent years, California has allocated a set amount of money to spend for the purchase of vehicles for Scrapping. The size of this fund determines the penetration that will be needed to target vehicles for scrappage each year. Once the penetration is determined, we can calculate the benefits and the other non-vehicle purchase costs incurred.

In the process of developing the I/M simulator, we found that being able to estimate the value of a scrappage vehicle candidate was critical to efficiently ranking the vehicle for scrappage. The best scrappage vehicle ranking methods used the estimated mass emissions of the vehicle over its remaining lifetime[18] divided by the value of the vehicle. This produced rankings that would maximize the reduction in vehicle emissions from Scrapping for a fixed vehicle purchase budget. Therefore, to estimate the purchase cost of vehicles that are targeted

[18] In this analysis the remaining lifetime of a vehicle was assumed to be 24 months.

for Scrapping, we need to be able to estimate the purchase cost for each individual vehicle. During the development of the I/M simulator, we created vehicle value estimating functions, which are based on vehicle make, vehicle type, and vehicle age.

A simple example will demonstrate why vehicle value is important for ranking vehicles for Scrapping. Suppose two vehicles have the same forecasted mass emissions over their remaining lifetime. One vehicle is a newer vehicle with a high value. The other vehicle is an older vehicle with a low value. If we base the selection of the vehicle solely on the mass of emissions remaining in the lifetime of the vehicle or even on the failure probability of the vehicle at the next I/M inspection, both vehicles will end up near each other in the ranking. However, the state would prefer to buy the lower valued vehicle for Scrapping. It makes more sense to repair the newer vehicle. The analysis indicates that using vehicle value in the ranking increases the emissions reduction for Scrapping by about a factor of three.

To estimate the size of the state's scrappage vehicle expenditure, we need to consider more than the value of each vehicle. In a Scrapping program, the state will not purchase every vehicle that is called in for a scrappage ASM. It will purchase only those vehicles that fail the scrappage ASM. Therefore, we need to consider the probability of ASM failure for each of the individual vehicles in the dataset at the time of the scrappage ASM. The I/M simulator provides these scrappage ASM failure probabilities. When we multiply the scrappage ASM failure probability by the estimated vehicle value, we get the probable purchase expense of each vehicle that is being targeted. The targeted vehicles for Scrapping are simply those from the top of the list whose sum of the vehicle probable purchase expense equals the state's purchase budget. We found that if the state's annual vehicle purchase budget were $8 million to purchase vehicles at their market value, depending on the method used to rank vehicles for Scrapping, between 0.24 and 0.62% of the I/M fleet would be targeted for a scrappage ASM in each biennium. Clearly, only a portion of the targeted vehicles would fail the scrappage ASM and therefore would be eligible for Scrapping purchase offers.

Vehicle repair costs – When special strategies are applied to the existing California I/M program, changes to the repair costs of individual vehicles that had been in the normal I/M process will occur. In the I/M simulator, we developed a method to quantify the size of these incremental repair cost changes by considering the size of the repair costs for the two paths under consideration for an individual vehicle: the normal I/M process path and a special strategy path. The time-dependent failure probabilities and the probability of completing the I/M program requirements in any given month, which were estimated by the I/M simulator, were used to forecast probable repair costs for individual vehicles for the different special strategies.

As an example, we configured a vehicle with different VID history and RSD measurement characteristics so that the calculations of vehicle repair costs would be estimated for a simulated low emitter and high emitter. The low emitter was simulated by setting the previous-cycle ASM results to all passes and the recent RSD measurements to the lowest possible concentration values. The high emitter was simulated by setting the previous-cycle ASM results to fail for ASM2525 NO and other ASM results to pass and the recent RSD measurements to low values for HC and CO but the RSD NO measurement to 7,800 ppm. The low emitter configuration was used to estimate the repair cost for Exempting in comparison with the normal I/M process. The high emitter configuration was used to examine the repair costs for Directing, Calling-In, and Scrapping in comparison with the normal I/M process. Table 6-7 shows a summary of the probable repair cost results from those calculations. The probable repair costs were calculated for the 48 months following the Decision Point, which is the date on which the decision is made to assign the vehicle to a special strategy or to let it remain in the normal I/M process.

Table 6-7. Probable Repair Costs Over 48 Months After the Decision Point for the Example Vehicle Description

Vehicle Emissions Characteristic	Intervention Strategy				
	Normal I/M Process	Exempting	Directing	Calling-In No-Sticker	Scrapping
Low Emitter	$7.78	$10.54	-	-	-
High Emitter	$98.32	-	$117.98	$140.80	$32.85

The table shows that the repair cost incurred by Exempting the low emitter is higher than if the low emitter is left in the normal I/M process. The increased repair cost is caused by the increase in probability of a repair being needed because the inspection is delayed two years. During this delay, the failure probability increases. In the case of Directing, which like Exempting occurs at the regularly scheduled biennial date, probable repair costs are higher than the corresponding repair cost for leaving the vehicle in the normal I/M process. This increase is due to the increased likelihood that a directed vehicle will fail the ASM test at a high-performing station compared to an average-performing station. The table shows that in the case of Calling-In, the probable repair costs are also higher than the repair costs for leaving the vehicle in the normal I/M process. A portion of the increased repair cost is due to the call-in ASM test which is an "extra" ASM test that the vehicle would not undergo if it remained in the normal I/M process. In the case of Scrapping, the probable repair cost for the high emitter was lower than the repair cost if the vehicle remained in the normal I/M process – but the repair cost was not zero. Of course, the future repair costs for vehicles that failed the scrappage ASM test would be

zero – because those vehicles would be scrapped. However, there is always the probability that the high emitter would pass the scrappage ASM test and therefore, continue in the I/M program. It would thereby incur future repair costs. Our calculations also took into account that the vehicles that passed the scrappage ASM test would be less likely to need repairs in the future and therefore the repair costs for the scrappage ASM-passing vehicles would be lower than for all vehicles of the same age.

To estimate the probable repair costs of the California I/M fleet we needed to generalize the results so that they would be representative of the incremental repair costs as a whole when portions of the fleet would take the Exempting, Directing, Calling-In, or Scrapping path instead of the normal I/M process path. We selected repair cost adjustment factors for each of the different special strategies that generalized the effect of the strategy on the change in repair cost of the strategy with respect to the repair cost for the normal I/M process. Those relative costs were taken from values similar to those in Table 6-7, but over a wide range of conditions, to produce the repair cost adjustment factors shown in Table 6-8.

Table 6-8. Repair Cost Adjustment Factors

Repair Cost Adjustment Factor	Intervention Strategy			
	Exempting	**Directing**	**Calling-In No-Sticker**	**Scrapping**
	+45%	+20%	+70%	-75%

For each of the different strategies, the change in repair cost is based on the number of vehicles that would have failed in the normal I/M process. To get the change in repair cost, the unit repair cost of $194[19] is multiplied by the repair cost adjustment factor from Table 6-8 for the corresponding strategy and multiplied by the number of targeted vehicles that would have failed if they had remained in the normal I/M process.

Notices – In the base case I/M program scenario, notices are sent to all owners to remind them that their inspection date is approaching. Since owners can be directed and exempted by making changes to the wording of the reminder letter, there are no incremental costs for Directing and Exempting. On the other hand, Calling-In and Scrapping are off-cycle activities for this analysis. Therefore, special notices, which cause incremental notice costs, need to be sent out. The cost for notices is the same whether RSD is used or not. The unit cost for each notice is $3.00.

[19] Unit repair cost provided by the Bureau of Automotive Repair.

Certificates – The incremental cost for certificates varies for the different special strategies. In the case of Directing, directed vehicles are tested at high-performing stations rather than average-performing stations. However, in both cases the same number of certificates would be issued. In the case of Exempting, exempted vehicles would still be required to get new certificates even though they did not receive an inspection. In the case of Calling-In, vehicles that are called-in would not receive a new certification, which represents no change beyond the base case I/M program scenario. In the case of Scrapping, vehicles that pass the scrappage ASM test would not be given a new certification, but would be required to continue following the requirements of their existing certification. Vehicles that fail the scrappage ASM test would not be required to get a new certification since those vehicles would be scrapped. Since they are removed from the fleet, the absence of future certifications is a credit. The unit cost of certificates is $8.25.

Inspections – For incremental inspections beyond the base case scenario, the situation is different for the different special strategies. For Directing, the same number of inspections would be performed whether the vehicles were tested at high-performing stations or at average-performing stations. Accordingly, there is no incremental cost for inspections for Directing. In the cases of Calling-In and Scrapping, the call-in and scrappage ASM tests are in addition to the base case I/M program scenario. Accordingly, incremental costs for call-in and scrappage inspections are incurred. In the case of Exempting, no exempted vehicles would receive an ASM test. The large cost credit associated with this large decrease in the number of inspections performed is the major incentive for Exempting vehicles. The unit cost for inspections is $50[20].

Model update and maintenance – Vehicle ranking software similar to that developed for this study would be used weekly to rank the vehicles for the special strategies. As the fleet ages and turns over, and as more data is added to the VID, the registration database, and the historical RSD dataset, updates to the ranking software will be required. We estimate that updates and maintenance of this software would cost $200,000 annually.

6.6 Evaluating the Benefits and Costs of Adding RSD to the IM Program

Our approach to evaluate the benefits and costs of supplementing the I/M program with an RSD component is to use different combinations of information sets to rank the vehicles for the four different special strategies. We used the I/M simulator to calculate the fleet benefits as described in Section 6.4 and costs as described in Section 6.5 for the set of 69,629 vehicles in the pilot study for which we had RSD measurements, VID records, and an initial-cycle ASM result

[20] Unit inspection cost provided by the Bureau of Automotive Repair.

after the RSD. We ranked these vehicles for targeting for each of the four strategies using the three individual vehicle ranking methods described in Section 6.3:

1) Individual vehicle VID records alone (VID-alone),

2) Individual vehicle RSD measurements alone (RSD-alone),

3) Individual vehicle VID records supplemented by individual vehicle RSD measurements (VID+RSD).

The results from these three methods were used to evaluate adding RSD to the existing I/M program over a wide range of penetrations for each of the four strategies. Specifically, comparing 2) with 1) reveals whether VID-alone or RSD-alone provides superior operating effectiveness, lower costs, and better cost-effectiveness for a given strategy. And comparing 3) with 1) reveals whether adding RSD measurement information to historical VID information will improve strategy performance. Performing these two comparisons is the source for the answers to five of the pilot study questions dealing with selection of vehicles for special strategies.

7.0 Evaluation of RSD's Ability to Select Individual Vehicles for Special Strategies: Cost-Benefit Analysis Results

In this section we present the benefits and costs for each of the four special strategies. Details of all of these results are presented in References 3 and 4. In the sub-sections below we present each strategy as implemented by itself:

- Calling-In vehicles between I/M cycles,
- Directing vehicles to high-performing stations,
- Exempting vehicles from I/M requirements, and
- Scrapping vehicles,

and then present the results for two packages of strategies:

- Four strategies (Calling-In, Directing, Exempting, and Scrapping)
- Three strategies (Directing, Exempting, and Scrapping).

The effectiveness of each of the three vehicle ranking methods (VID-alone, RSD-alone, VID+RSD) was calculated by projecting (for each of the future 24 months) which of the vehicles selected by each method would fail a Smog Check inspection in a regular I/M station (i.e., not a Referee or a roadside inspection) and how much benefit would be realized by their repair. The first benefit is the fleet's ΔFailed Miles Driven over the two years after the decision to select or not select each individual vehicle. The second benefit is the fleet's ΔFTP HC+NOx over the same two-year period. The calculations also determine the number of vehicles targeted and the number of vehicles that would fail an ASM test at the decision point.

We estimated costs for setting up and running the RSD program, administration costs, and costs associated with inspections and repair of additional vehicles specific to each strategy. All cost and benefit numbers assume that all targeted vehicles participate in the strategy. Details of the costs for each activity are described in Reference 4.

We estimated the costs and benefits for using other methods to select vehicles for special I/M program strategies including selection by model year, by vehicle description, which is similar to the current HEP, and by RSD measurement with ASM cutpoints [4]. Some methods used RSD data and some did not. The non-RSD information does not require field data collection, so it can be routinely obtained at low cost.

7.1 Calling-In Vehicles Between I/M Cycles

In this section we describe the benefits and costs for calling-in without the implementation of any other strategy. The current Smog Check program does not call-in vehicles between regular inspection cycles (referred to as "off-cycle" inspections), so the baseline program we compared costs and benefits to also did not call-in vehicles "off-cycle." Table 7-1 shows the strategy evaluation quantities for a comparison of the three key vehicle selection methods for identifying the top 5% high-risk vehicles and calling them in for inspection and potential repair between their regular I/M inspections.

The first row shows the number of vehicles targeted for calling-in. Note that the number targeted for RSD-alone is 30% of the numbers targeted for the other two selection methods. The reason for this is that even with the largest RSD measurement program, which obtains valid, DMV-matched RSD readings on 50% of the vehicles driving in the five largest AQMDs, usable RSD measurements can be obtained on only 30% of the vehicles in the statewide I/M fleet. The second row shows the number of vehicles expected to fail at the decision point. The third row shows the percent of the targeted vehicles that are expected to fail the call-in ASM test at the decision point. While RSD-alone targets failing vehicles more efficiently (43.5% vs. 33.2% and 35.2%) than the other two selection methods do, the observed fail rate is not up to the high fail rates (such as 90% or more) that are desired when vehicles are called-in off-cycle.

The fourth and fifth rows show the calculated benefits of the calling-in strategy at 5% fleet penetration. All three methods provide some benefits for the California fleet. The VID + RSD method provides the largest benefits for this strategy; however, the VID-alone method is not far behind. At 5% targeting, the VID + RSD method reduces FTP HC + NOx by about 230 more tons per 2 years than the VID-alone method does. Hence, RSD does help VID-alone in providing some additional emissions benefit. The RSD-alone method produces the smallest reduction in emissions – even though the ASM Fail Rate at Decision Point was the highest. The two main reasons for the poorer performance of RSD-alone are that only 30% of the statewide I/M fleet will have usable RSD measurements and the RSD-alone method can rank vehicles only by their expected ASM Fail Rate at Decision Point rather than by expected ΔFailed Miles Driven.

Table 7-1. Cost-Benefit Summary for Calling-In[a,b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 5% Targeting (N)		669,403	202,669	669,403	
Targeted Vehicles that Fail ASM at Decision Point (N)		222,039	88,237	235,806	13,767 more vehicles to fail
ASM Fail Rate at Decision Point (%)		33.2%	43.5%	35.2%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **972,447,180** failed miles driven	A decrease of **129,859,872** failed miles driven	A decrease of **1,012,914,979** failed miles driven	A further decrease of **40,467,799** failed miles driven
	Total ΔFTP HC+NOx (tons/2years) [f]	A decrease of **4,595** tons	A decrease of **994** tons	A decrease of **4,825** tons	A further decrease of **230** tons
Total Costs ($/2years)		**$ 72,915,946** spent	**$ 79,820,101** spent	**$ 127,029,468** spent	A further increase of **$ 54,113,525** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 15,870** spent for each ton of emissions reduced	**$ 80,283** spent for each ton of emissions reduced	**$ 26,329** spent for each ton of emissions reduced	An additional **$ 235,067** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a high-emitter Calling-In strategy that targets 5% of the I/M fleet.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

The cost effectiveness of each method is listed on the bottom row of Table 7-1. For example, for the VID-alone method, the total costs of the program would be about $73 million every two years. That cost is associated with reducing FTP HC+NOx emissions by about 4,600 tons every two years over (incremental to) the baseline program. The resulting cost effectiveness is calculated from those two numbers at about $16,000 per ton of HC+NOx. As shown, using RSD-alone produces smaller emissions reductions at substantially higher cost. The result is that RSD-alone is quite cost-ineffective at $80,000 per ton.

The last column of Table 7-1 shows that adding RSD information to VID information for calling-in is very cost-ineffective. Adding RSD helps in that VID+RSD performs better than either RSD-alone or VID-alone. However, 95% (=4595/4825) of the benefit of VID+RSD and only 57% (=$72,915,946/$127,029,468) of the cost of VID+RSD is provided by VID-alone.

The benefits, costs, and cost-effectiveness results for Calling-In at 2%, 5%, 7%, and 10% penetrations are shown in Appendix A Tables A-1, A-2, A-3, and A-4. All of the tables are for the large RSD program, which has 50% any-VSP coverage. As penetration increases, the total FTP HC + NOx benefits increase for all three vehicle selection methods, but the amount of increase with each penetration increase gets smaller. As penetration increases, the cost-effectiveness degrades for the VID-alone vehicle selection method, but improves for the RSD-alone and VID+RSD methods. Nevertheless, the VID-alone method is cost-effective at 2% targeting, and the RSD-alone and VID+RSD methods are not cost-effective at any of the penetrations evaluated. Finally, as the penetration increases, the incremental cost-effectiveness of adding RSD to the VID-alone method improves, but it is always worse than $160,000/ton for the penetrations evaluated. We have also investigated the effect of the size of the RSD measurement program on cost-effectiveness and found that even for smaller RSD measurement efforts the cost-effectiveness of Calling-In using RSD information continues to be not cost-effective.

We also simultaneously investigated the effect of the size of the RSD measurement program and the penetration. We found that the best cost-effectiveness for the RSD-alone vehicle selection method for Calling-In was in the vicinity of 22% any-VSP coverage with a penetration of 27%. This program had a cost-effectiveness of about $40,000/ton. We could find no other combination of RSD program size and penetration that had a better cost-effectiveness for Calling-In.

7.2 Directing Vehicles to High-Performing Stations

High-performing stations are those stations that can more reliably measure the ASM pass/fail status of a vehicle more accurately than the average I/M station can. High-performing

stations tend to have higher fail rates than average-performing stations because vehicles inspected at high-performing stations are more likely to get needed repairs than if they had been inspected at average-performing stations. Therefore, Directing vehicles to high-performing stations results in higher fleet-average emissions reductions. Ideally, we would want to direct the fleet's highest risk vehicles to high-performing stations. The highest risk vehicles are those that are expected to drive a large number of ASM-failed miles and produce a large mass of emissions over the next two years.

Currently, the State uses a High Emitter Profile (HEP) model to direct some vehicles to high-performing stations. An improved HEP could have inputs from either the Vehicle Information Database (VID), which is maintained by the Smog Check program, or from RSD data collected in the five largest AQMDs, or from both sources. To provide the information for the three basic ranking methods (VID-alone, RSD-alone, VID+RSD), we used three of the eleven improved HEPs developed in this study.

Table 7-2 shows the results of the cost-benefit analysis for Directing using a 40% fleet targeting level (40% was selected solely for demonstration purposes). This means that, after the vehicles are ranked by a vehicle selection method, the top 40% of the vehicles were chosen to participate in the Directing calculations. The first row in the table shows the number of vehicles targeted for Directing. The number targeted by RSD-alone is 30% of the numbers targeted by the other two methods since the RSD program can provide usable RSD readings on only 30% of the statewide I/M fleet. The second row of the table shows the increase in the number of vehicles that would fail the ASM at Decision Point as a result of being tested at a high-performing station versus the number that would have failed at an average-performing station. The third row shows this number expressed as a percentage of the number of targeted vehicles for each vehicle selection method. These increased counts and ASM Fail Rates at Decision Point are based on the assumption that average stations fail 80% of the vehicles that would have failed at high-performing stations [4].

The fourth and fifth rows show the size of the benefits in terms of ΔFailed Miles Driven and ΔFTP HC + NOx. The largest benefits are seen for the VID + RSD vehicle selection method. However, just as for Calling-In, we see that the VID-alone method is almost as good. Again, the RSD-alone method shows the smallest benefit for the three vehicle selection methods. This is the result of RSD being able to obtain usable measurements on only 30% of the vehicles in the statewide I/M fleet and of the ranking of vehicles by the expected ASM Fail Rate at Decision Point rather than by ΔFailed Miles Driven.

Table 7-2. Cost-Benefit Summary for Directing[a,b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 40% Targeting (N)		5,355,228	1,621,355	5,355,228	
Δ^i Targeted Vehicles that Fail ASM at Decision Point (N)		115,080	41,232	120,727	5,647 more vehicles to fail
Δ^i ASM Fail Rate at Decision Point (%)		2.1%	2.5%	2.3%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **594,758,300** failed miles driven	A decrease of **172,236,354** failed miles driven	A decrease of **616,084,457** failed miles driven	A further decrease of **21,326,157** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **4,339** tons	A decrease of **1,303** tons	A decrease of **4,489** tons	A further decrease of **150** tons
Total Costs ($/2years)		**$ 25,785,903** spent	**$ 63,433,712** spent	**$ 79,125,359** spent	A further increase of **$ 53,339,459** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,943** spent for each ton of emissions reduced	**$ 48,680** spent for each ton of emissions reduced	**$ 17,628** spent for each ton of emissions reduced	An additional **$ 356,496** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that annually obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a high-emitter Directing strategy that targets 40% of the I/M fleet.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

The sixth row shows the total costs for the three vehicle selection methods. The costs for the second and third methods, which include RSD measurements, are substantially higher than the cost for the VID-alone method, which does not require on-going RSD measurements. The last row shows the cost-effectiveness values in $/ton and indicates that the VID-alone method is cost-effective and the methods that use RSD are not.

In summary, the RSD-alone method captures about 30% of the ΔFailed Miles Driven and the ΔFTP HC + NOx at about two and one-half times the cost of VID-alone. This makes Directing using RSD-alone unattractive at $48,000/ton. The VID + RSD method actually captures slightly more ΔFailed Miles Driven and ΔFTP HC + NOx emissions than VID-alone but it is also not cost-effective because the cost of performing the RSD measurements is high.

The last column in the table shows the incremental numbers for adding RSD information to VID information. Doing this does increase the benefits of Directing by 150 tons over 2 years; however, the increase in cost is $53 million since the entire large RSD program must be instituted to get the RSD measurements needed to gain the 150 tons.

The benefits, costs, and cost-effectiveness of Directing for 20%, 30%, 40%, and 50% penetrations are shown in Appendix A Tables A-5, A-6, A-7, and A-8. All of the tables are for the large RSD program, which has 50% any-VSP coverage. As penetration increases, the total FTP HC + NOx benefits increase for all three vehicle selection methods, but the amount of increase with each 10% penetration increase gets smaller. As penetration increases, the cost-effectiveness improves for all three vehicle selection methods; however, the VID-alone method is always cost-effective and the RSD-alone and VID+RSD methods are never cost-effective. Finally, as penetration increases, the incremental cost-effectiveness of adding RSD to the VID-alone method gets worse and is always above $300,000 per ton.

We have also investigated the effect of the size of the RSD measurement program on cost-effectiveness and found that even for smaller RSD measurement efforts the cost-effectiveness of Directing using RSD information continues to be not cost-effective.

7.3 Exempting Vehicles from I/M Requirements

We explored several methods for using RSD to exempt (also called “clean screen”) vehicles from Smog Check and compared them to methods that do not rely upon RSD. We only investigated options that are incremental to a baseline program similar to the current Smog Check program, which already exempts the most recent six model years from I/M. Our baseline program and the current Smog Check program are identical with respect to “clean screen.” So,

the costs and benefits we present are incremental to the current Smog Check program. The cost and benefit results for the three key vehicle selection methods are summarized in Table 7-3. In this example we present an aggressive "clean screen" that exempts 20% of the vehicles beyond those currently exempted due to their age.

The disadvantage of exempting vehicles from I/M is that a small fraction of them would have failed the inspection and presumably would have gotten needed repairs. By erroneously exempting these few vehicles, a small amount of failed-miles-driven and emissions-reduction benefits are lost. Since those reductions are not realized, exempting a meaningful number of vehicles will always increase fleet failed miles driven and emissions to some extent. The goal is to intelligently select the vehicles so that the small loss in benefits is minimized. Table 7-3 shows that for 20% fleet targeting, the lowest increase of the three methods is provided by RSD-alone with about 944 tons increase over 2 years. However, since RSD measurements would be available on only about 30% of the statewide I/M fleet, 70% of the fleet is not covered by RSD-alone and does not get a chance to be exempted. Accordingly, the primary reason that the 944 ton number is so low is that it applies to only 30% of the statewide I/M fleet. Of the methods in Table 7-3 that cover the entire fleet, the one resulting in the lowest FTP HC+NOx emissions increase with 2,018 tons over two years is VID + RSD together.

From the perspective of costs, the strategy of exempting vehicles is different than the other strategies because it can actually lead to a net savings. When a vehicle is exempted, the owner no longer must pay for an inspection or a repair, which usually would not have been necessary anyway for these vehicles. Exempting also improves the convenience of the I/M program to the public. Vehicle owners avoid traveling to the inspection station and waiting for the inspection. If enough vehicles are exempted, and if the other costs that go into exempting vehicles are low enough, a savings to vehicle owners is realized in the form of more money remaining in their pockets for other uses.

Table 7-3. Cost-Benefit Summary for Exempting[a,b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 20% Targeting (N)		2,677,614	810,678	2,677,614	
Targeted Vehicles that Fail ASM at Decision Point (N)		58,371	7,071	50,794	7,577 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		2.2%	0.9%	1.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **143,777,037** failed miles driven	An increase of **48,037,384** failed miles driven	An increase of **106,007,297** failed miles driven	The reduction of an additional **37,769,740** failed miles driven are preserved
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	An increase of **2,358** tons	An increase of **944** tons	An increase of **2,098** tons	An additional **260** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 74,449,922**	**$ 30,921,021** spent	A savings of **$ 22,867,465**	A further increase of **$ 51,582,461** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 31,573** for each ton of emissions increased	**$ 32,772** spent for each ton of emissions increased	A savings of **$ 10,901** for each ton of emissions increased	An additional **$ 198,230** spent for each additional ton of emission reductions not lost through exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that annually obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a low-emitter Exempting strategy that targets 20% of the I/M fleet.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

An example of such a savings is shown in Table 7-3 under the column for the VID-alone vehicle selection method. The savings of more than $74 million comes from exempting 20% of the vehicles that are not already exempted because of their age. Unfortunately for the agencies implementing the program, the program savings do not increase funds to spend administering the program. But perhaps the savings to the public would justify a request of more funds to improve other aspects of the State's efforts at reducing on-road pollution. One can also see in Table 7-3 that for the methods that use RSD readings, the savings are much less; the RSD-alone method actually costs money, which defeats the purpose of Exempting. The reason for this is that the large cost of RSD data collection offsets the savings from the large reduction in the number of inspections that Exempting produces.

The previously mentioned cost savings and improved convenience of exemptions somewhat mitigate the emissions increases. So we compare the methods for Exempting by noting which methods have the smallest emissions increase and result in the highest net savings to the public. A scenario that saves money has promise for inclusion into a suite of strategies, as long as the other strategies reduce pollution enough to offset the increases from the exemptions. The RSD-alone method is not attractive because this vehicle selection method costs millions of dollars to increase fleet failed miles driven and mass emissions. On the other hand, the VID-alone method is quite attractive. While it does allow failed miles driven and emissions to increase, the increases are not substantially larger than those for the VID + RSD vehicle selection method, which costs $51 million more than the VID-alone method.

Comparison of the cost-effectiveness value for the VID-alone method for Exempting with the Carl Moyer criterion suggests an attractive opportunity. Usually we think of the Carl Moyer criterion in this way: If the cost of "buying" emissions is <u>less</u> than $14,300 per ton, the purchase is attractive. That use of the criterion applies to Calling-In, Directing, and Scrapping. But we can turn the Carl Moyer criterion around in this way: If the income from "selling" emissions is <u>more</u> than $14,300 per ton, the <u>sale</u> is attractive. This statement applies to Exempting by the VID-alone method where more than $31,000 is saved for each ton of HC and NOx emitted. Thus, the cost-benefit analyses reveal that with the VID-alone method we can "sell" emissions for $31,573 per ton using Exempting and then use the money to "buy" emissions at $5,943 per ton using Directing (see Table 7-2) and at $5,385 per ton using Scrapping (see Table 7-4).

As shown in Table 7-3, when RSD is compared to other, similarly effective methods, the additional cost of using RSD to identify vehicles only for Exempting is not justified for California.

Tables A-9, A-10, A-11, A-12, and A-13 show the results of the cost-effective analysis for Exempting penetrations of 5%, 10%, 20%, 30%, and 40%. All of the tables are for the large RSD program, which has 50% any-VSP coverage. As penetration increases, the total FTP HC + NOx left emitting to the airshed increase rapidly (and at least proportionately to the penetration) for all three vehicle selection methods. As penetration increases, for the VID-alone method, the savings per ton of emissions released tends to decrease. Nevertheless, for all penetrations evaluated, the "sale" of emissions from Exempting is attractive from the Carl Moyer perspective (that is, the savings per ton is greater than $14,300). On the other hand, the RSD-alone method never provides an attractive opportunity to "sell" emissions. That is, the RSD-alone method always costs money to release extra emissions to the airshed – a disbenefit from two perspectives. Finally, as penetration increases, the incremental cost-effectiveness of adding RSD to the VID-alone method improves, but the cost-effectiveness is always greater than $130,000 per ton.

7.4 Scrapping Vehicles

A vehicle retirement (Scrapping) program that operates like the one currently run by BAR would solicit the purchase of vehicles "off cycle" between their regular inspections. We simulated a program that would ask vehicle owners to come for a voluntary, "off-cycle" inspection, which we call a scrappage ASM. For the purposes of evaluating the benefits and costs of the simulated Scrapping program, we assumed that if a vehicle failed the scrappage ASM test, the vehicle would be purchased by the State for the market value of the vehicle. This approach allows us to estimate the average value of vehicles that would be targeted for Scrapping. Program administrators need to have estimates of vehicle values of scrappage candidates so that they can determine the size of vehicle purchase offers. Clearly, in the real application of a Scrapping strategy, the owner's perception of the value of his vehicle will be important in determining whether he will accept an offer. Vehicle owners will not likely accept an offer that does not include at least some above-market-value incentive.

The three vehicle selection methods evaluated in Table 7-4 use combinations of two data sources to target the vehicles: the Vehicle Information Database maintained by the Smog Check program, and RSD data collected on roadways in California. All three options targeted purchasing a group of vehicles with the largest mass emissions with a total fair market (Blue Book) value of approximately $16 million.

Table 7-4. Cost-Benefit Summary for Scrapping[a,b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID alone causes:**
Targeted Vehicles [c] (N)		58,908	38,102	54,891	
Targeted Vehicles that Fail ASM at Decision Point (N)		22,936	17,388	23,020	85 more vehicles to fail
ASM Fail Rate at Decision Point (%)		38.9%	45.6%	41.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **190,210,114** failed miles driven	A decrease of **158,294,190** failed miles driven	A decrease of **200,080,890** failed miles driven	A further decrease of **9,870,776** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **3,478** tons	A decrease of **2,566** tons	A decrease of **3,612** tons	A further decrease of **135** tons
Total Costs ($/2years)		**$ 18,728,744** spent	**$ 70,487,724** spent	**$ 71,056,304** spent	A further increase of **$ 52,327,563** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,385** spent for each ton of emissions reduced	**$ 27,468** spent for each ton of emissions reduced	**$ 19,670** spent for each ton of emissions reduced	An additional **$ 388,824** spent for each additional ton of emissions reduced
Average Market Value of Targeted Vehicles ($)		$ 683	$ 903	$ 694	

[a] The costs and benefits presented in this table are for a large RSD measurement program that annually obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a high-emitter Scrapping strategy that spends approximately $16,000,000 over two years to purchase vehicles for scrappage.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table 7-4 shows the summary of the cost-benefit analysis for Scrapping. Targeting vehicles for Scrapping is based on the size of the budget allocated to purchasing vehicles for scrappage. The I/M simulator indicates that for a biennial scrappage budget of $16 million, approximately 0.24% to 0.62% of the I/M fleet would be targeted depending on the vehicle selection method. The second row in Table 7-4 shows the number of targeted vehicles that would fail the scrappage ASM test. The third row shows that vehicles targeted by RSD-alone would have a higher fail rate than either of the other two vehicle selection methods. The fourth and fifth rows of the table show the benefits for ΔFailed Miles Driven and total ΔFTP HC + NOx for the three vehicle selection methods. The largest benefits are seen for VID + RSD together. However, as we have seen for the other three strategies, the VID-alone method has benefits that are almost as good. The RSD-alone method, even though it demonstrates a higher ASM Fail Rate at Decision Point, has poorer performance because only 30% of the statewide I/M fleet is accessible by this large RSD measurement program. This RSD coverage limitation causes the selection of the scrappage candidate vehicles to cut deeper into the ranking than for the other two methods in order to spend the $16 million purchase budget. Thus, the RSD-alone method selects fewer vehicles for scrappage, and these vehicles on average are lower emitting and are higher valued than the vehicles selected by the other two methods.

The last row of Table 7-4 shows the average market value of the vehicles selected by each method. To have a hope of purchasing vehicles that fail the scrappage ASM test, the state will probably need to offer owners somewhat more than the market value of each vehicle. Thus, the State would need to offer more, on the average, for vehicles selected by RSD-alone than for vehicles selected by VID-alone or VID + RSD together. This consideration puts the RSD-alone method at a disadvantage in comparison with the other two methods.

The sixth row shows the total cost for the three methods. The costs for the VID-alone method are significantly lower than the cost for the other two methods, which include on-going RSD measurements of the on-road fleet. The cost-effectiveness in terms of $/ton are shown in the seventh row of Table 7-4. These values indicate that vehicle selection by VID-alone is cost-effective, but both methods that use RSD measurements are not cost-effective.

Tables A-14, A-15, A-16, and A-17 in Appendix A show the cost-effectiveness analysis results for biennial purchase budgets of $8, $16, $32, and $64 million. All of the tables are for the large RSD program, which has 50% any-VSP coverage. In general as the biennial purchase budgets for Scrapping increase, the penetration increases. As the budget increases, the total FTP HC + NOx benefits increase for all three vehicle selection methods. As the budget increases, the cost-effectiveness degrades slightly for VID-alone and improves for RSD-alone and VID+RSD

vehicle selection methods; however, the VID-alone method is always cost-effective and the RSD-alone and VID+RSD methods are never cost-effective. Finally, for the different biennial purchase budgets, the incremental cost-effectiveness of adding RSD to the VID-alone method is always above $300,000 per ton.

We also simultaneously investigated the effect of the size of the RSD measurement program and the size of the biennial purchase budget on cost-effectiveness. We found that the best cost-effectiveness for the RSD-alone vehicle selection method for Scrapping was in the vicinity of 20% any-VSP coverage with a biennial vehicle purchase budget of about $16 million dollars. This program had a cost-effectiveness of about $15,000/ton. We could find no other combination of RSD program size and biennial purchase budget that had a better cost-effectiveness.

7.5 Four Strategies in Combination

In the previous four sub-sections, we presented cost-benefit results for each strategy when each strategy is used by itself as a supplement to the existing I/M program. However, some types of costs – primarily the RSD measurement costs – can be shared by strategies if several strategies were used simultaneously. Accordingly, in this sub-section we report an additional cost-benefit analysis for the combined use of all four strategies. The effects of Calling-In, Directing, Exempting, and Scrapping were calculated at respective fleet targeting percentages of 5%, 40%, 20% and biennially spending $16 million for scrappage vehicle purchase.

The total benefits from the four strategies are shown in Table 7-5 and are based on the three vehicle ranking methods. The various values for number of targeted vehicles, number of targeted vehicles that would fail an ASM test at the decision point, and the ASM fail rate at the decision point are the same values that were presented in Tables 7-1, 7-2, 7-3, and 7-4 for the corresponding strategies. The total emissions benefit of 10,828 tons/2years is largest for the VID + RSD method, while the best non-RSD ranking method (VID-alone) results in emissions benefits of 10,053 tons/2years – almost as large. Thus, the incremental benefits of the best RSD model over the best non-RSD model are about 775 tons/2years, which is about 0.13% of the I/M fleet biennial emissions inventory, but these incremental emissions reductions come at a significantly higher cost – $54,631,106 higher.

Table 7-5. Cost-Benefit Summary for Calling-In, Directing, Exempting, Scrapping[a,b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] (N)		Various See Table B-3	Various See Table B-3	Various See Table B-3	
Targeted Vehicles that Fail ASM at Decision Point (N)		Various See Table B-3	Various See Table B-3	Various See Table B-3	
ASM Fail Rate at Decision Point (%)		Various See Table B-3	Various See Table B-3	Various See Table B-3	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **1,613,638,558** failed miles driven	A decrease of **412,353,033** failed miles driven	A decrease of **1,723,073,029** failed miles driven	A further decrease of **109,434,472** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **10,053** tons	A decrease of **3,920** tons	A decrease of **10,828** tons	A further decrease of **775** tons
Total Costs ($/2years)		**$ 32,599,772** spent	**$ 78,358,444** spent	**$ 87,230,874** spent	A further increase of **$ 54,631,106** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 3,243** spent for each ton of emissions reduced	**$ 19,990** spent for each ton of emissions reduced	**$ 8,056** spent for each ton of emissions reduced	An additional **$ 70,526** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that annually obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a high-emitter Calling-In strategy that targets 5% of the I/M fleet, a high-emitter Directing strategy that targets 40% of the I/M fleet, a low-emitter Exempting strategy that targets 20% of the I/M fleet, and a Scrapping strategy that spends approximately $16,000,000 over two years to purchase vehicles for scrappage.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

The costs for each aspect of the activity and the expected benefits are presented in Table 7-6. Note that for the VID-alone method, the total costs are dominated by the savings associated with the exemption of 20% of the fleet. By Exempting 20% of the fleet, we estimate that there is a savings of $83 million because a large part of the fleet does not get inspected. For the RSD models, the costs are dominated by the $52 million spent collecting RSD measurements in the five major AQMDs in the state, as well as by the $83 million savings from Exempting.

According to Table 7-5, the cost-effectiveness of the VID-alone method is attractive at only about $3,200 per ton. On the other hand, the cost-effectiveness of the VID + RSD method is $8,056/ton of HC and NOx emissions. While this is two and one-half times higher than the cost-effectiveness of the VID-alone method, it is a substantial improvement over the VID + RSD method values when strategies were considered singly in the previous four sub-sections and is a consequence of sharing the RSD measurement cost among the four strategies. While the cost-effectiveness of VID + RSD meets the Carl Moyer criterion, almost all of its cost-effectiveness is a result of VID information: 93% (=10,053/10,828) of the emissions benefits and only 37% (=$32,599,772/$87,830,874) of the costs are derived from the VID information. Adding the RSD information buys only slightly more tons of emissions at great cost. And the cost-effectiveness of RSD-alone at $19,990/ton is substantially below the Carl Moyer criterion of $14,300/ton.

Table 7-5 provides the cost-benefit analysis results for the large RSD program coverage of the fleet, that is, at 50% any-VSP RSD coverage. Appendix B provides the same results for smaller RSD programs that have 10% and 30% any-VSD RSD coverage.

7.6 Three Strategies in Combination

The previous sub-section presented the cost-benefit analysis results for a combination of all four strategies. The cost-benefit results for the situations when each strategy was used by itself indicated attractive results for the VID-alone method for Directing, Exempting, and Scrapping. On the other hand, the cost-benefit results for Calling-In were not attractive for any of the three vehicle selection methods. The most cost-effective implementation for Calling-In (see Table 7-1) was nearly $16,000 per ton of HC + NOx. This suggests that the use of a package of the three attractive strategies might be even more cost beneficial than the combination of all four strategies. Accordingly, in this sub-section, we present the cost-benefit results for a combination of strategies made up of Directing, Exempting, and Scrapping.

Table 7-6. Cost Details for the Four Strategy Combination

Cost Items ($/2years)		Vehicle Selection Method			Incremental RSD Cost (VID+RSD over VID)
		VID alone	RSD alone	VID+RSD together	
Penetration	Strategy				
Central Office					
5%	Calling-In No-Sticker	$6,884,584	$4,745,749	$7,178,438	$293,854
40%	Directing				
20%	Exempting				
16M$	Scrapping				
RSD Measurements					
5%	Calling-In No-Sticker	$0	$51,950,113	$51,950,113	$51,950,113
40%	Directing				
20%	Exempting				
16M$	Scrapping				
Notice					
5%	Calling-In No-Sticker	$2,008,210	$608,008	$2,008,210	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	$176,723	$114,306	$164,673	($12,049)
Certificate					
5%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	($189,220)	($143,450)	($189,918)	($698)
Inspection					
5%	Calling-In No-Sticker	$33,470,173	$10,133,471	$33,470,173	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	($83,006,028)	($25,131,008)	($83,006,028)	$0
16M$	Scrapping	$2,945,375	$1,905,093	$2,744,554	($200,821)
Repair					
5%	Calling-In No-Sticker	$30,152,846	$11,982,574	$32,022,403	$1,869,558
40%	Directing	$22,325,603	$7,999,007	$23,421,095	$1,095,492
20%	Exempting	$5,095,806	$617,325	$4,434,299	($661,507)
16M$	Scrapping	($3,337,149)	($2,529,944)	($3,349,467)	($12,318)
Vehicle Purchases					
5%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	$15,672,716	$15,707,016	$15,982,198	$309,482
Model Update & Maintenance					
5%	Calling-In No-Sticker	$400,000	$400,000	$400,000	$0
40%	Directing				
20%	Exempting				
16M$	Scrapping				

Table 7-7 shows the benefits, costs, and cost-effectiveness numbers for this combination using the same vehicle targeting percentages as have been used previously. The only difference is that the cost and benefits for Calling-In have not been included. The table shows that the benefits of ΔFailed Miles Driven and ΔFTP HC + NOx are the largest for the VID + RSD method, but the benefits for the VID-alone method are almost as large. The RSD-alone method does not perform as well, just as we have seen for all other cost-benefit analyses in this study. The individual costs for this combination of three strategies are summarized in Table 7-8. Except for central office costs and the costs specific to Calling-In, these values are the same values as were shown in Table 7-6 for the four strategy combination. The resulting total costs shown in Table 7-7 indicate a large cost savings for the VID-alone vehicle selection method. For the RSD-alone and VID + RSD methods, the total costs are large since they are dominated by the cost of the RSD measurement program.

In terms of cost-effectiveness, the VID-alone combination of three strategies is particularly attractive since the benefits of ΔFailed Miles Driven and ΔFTP HC + NOx are almost as large as the best vehicle ranking method, which is VID + RSD, yet the VID-alone method saves almost $37 million every two years.

Table 7-7 shows that attempting to improve the VID-alone method by supplementing the VID information with RSD information is not cost-effective. The calculations in the last column indicate that the cost increases by almost $100,000 for each additional ton of emissions reduced with supplemental RSD information. We have found this cost-effectiveness value gets smaller (that is, better) as the RSD program coverage gets smaller. However, the incremental RSD cost-effectiveness for adding RSD to the VID-alone method is always greater than about $27,000 Therefore, adding RSD measurements to a small program for these strategies is still not cost-effective.

Table 7-7. Cost-Benefit Summary for Directing, Exempting, Scrapping[a, b]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] (N)		various	various	various	
Targeted Vehicles that Fail ASM at Decision Point (N)		various	various	various	
ASM Fail Rate at Decision Point (%)		various	various	various	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **641,191,378** failed miles driven	A decrease of **282,493,161** failed miles driven	A decrease of **710,158,051** failed miles driven	A further decrease of **68,966,673** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **5,459** tons	A decrease of **2,926** tons	A decrease of **6,003** tons	A further decrease of **544** tons
Total Costs ($/2years)		A savings of **$ 36,855,875**	**$ 53,973,048** spent	**$ 15,905,670** spent	A further increase of **$ 52,761,548** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 6,752** for each ton of emissions reduced	**$ 18,448** spent for each ton of emissions reduced	**$ 2,650** spent for each ton of emissions reduced	An additional **$ 96,914** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that annually obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[b] The costs and benefits presented in this table are for a high-emitter Directing strategy that targets 40% of the I/M fleet, a low-emitter Exempting strategy that targets 20% of the I/M fleet, and a Scrapping strategy that spends approximately $16,000,000 over two years to purchase vehicles for scrappage.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table 7-8. Cost Details for the Three Strategy Combination

Cost Items ($/2years)		Vehicle Selection Method			Incremental RSD Cost (VID+RSD over VID)
		VID alone	RSD alone	VID+RSD together	
Penetration	Strategy				
Central Office					
0%	Calling-In No-Sticker	$3,060,165	$3,084,407	$3,354,019	$293,854
40%	Directing				
20%	Exempting				
16M$	Scrapping				
RSD Measurements					
0%	Calling-In No-Sticker	$0	$51,950,113	$51,950,113	$51,950,113
40%	Directing				
20%	Exempting				
16M$	Scrapping				
Notice					
0%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	$176,723	$114,306	$164,673	($12,049)
Certificate					
0%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	($189,220)	($143,450)	($189,918)	($698)
Inspection					
0%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	($83,006,028)	($25,131,008)	($83,006,028)	$0
16M$	Scrapping	$2,945,375	$1,905,093	$2,744,554	($200,821)
Repair					
0%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$22,325,603	$7,999,007	$23,421,095	$1,095,492
20%	Exempting	$5,095,806	$617,325	$4,434,299	($661,507)
16M$	Scrapping	($3,337,149)	($2,529,944)	($3,349,467)	($12,318)
Vehicle Purchases					
0%	Calling-In No-Sticker	$0	$0	$0	$0
40%	Directing	$0	$0	$0	$0
20%	Exempting	$0	$0	$0	$0
16M$	Scrapping	$15,672,716	$15,707,016	$15,982,198	$309,482
Model Update & Maintenance					
0%	Calling-In No-Sticker	$400,000	$400,000	$400,000	$0
40%	Directing				
20%	Exempting				
16M$	Scrapping				

8.0 Evaluation of RSD's Ability to Characterize Fleet Emissions

Two of the pilot study questions involve investigating RSD's ability to measure the on-road exhaust emissions of the fleet and subsets of the fleet. These questions are specifically targeted at uses of RSD measurements that are not related to targeting individual vehicles for individual treatment such as in special strategies. This section discusses RSD's ability to characterize the emissions of the on-road fleet in general, to evaluate the I/M program, and to verify the benefits of emission-reduction strategies. This includes evaluation of vehicles that are not participating in the I/M program such as out of area and out of state vehicles.

For an on-road test to be effective at characterizing the tailpipe emissions of the fleet and subsets of the fleet, it must have certain attributes. RSD developers and analysts have been working for several years to ensure that RSD measurements are taken in such a way that they meet these attributes:

1) The test needs to provide an unbiased measure of on-road tailpipe emissions across the full range of emission levels. For characterizing the emissions of a fleet, it doesn't matter greatly if the test provides measurements that are randomly scattered around the characteristic emissions values of vehicles. The reason for this is that averaging large numbers of measurements will produce average emissions levels with low uncertainty.

2) The test needs to cover a representative sample of the fleet. This includes all vehicle types, emission control system technologies, and ages. It is alright if the sample obtained randomly is somewhat unrepresentative of the fleet as long as the bias in the sample can be estimated and then corrected. An example of this is the bias in the model year distribution that occurs in RSD samples which is caused by the well-known tendency of new vehicles to have higher annual vehicle miles traveled.

3) The test must be performed either at the operating modes that the vehicles use or at a subset of operating modes that produce emissions characteristic of emissions at the operating modes that the vehicles use. This attribute is also one of sample representativeness.

4) The test must be conducted without vehicle owners knowing in advance that their vehicles will be tested. This attribute is required so that vehicle owners do not perform pretest repairs and, therefore, bias the results of the measurements.

5) The test must be conducted without the possibility that the test operator can influence the outcome of the test.

6) The test must be performed so that vehicles are sampled at random times with respect to their I/M cycles.

If the on-road test results are to be used to estimate emissions inventory, there is an additional requirement:

7) The test result must be convertible to a mass emissions basis so that the mass emissions of individual vehicles can be summed to get the inventory. This means that the relative usage of different vehicles needs to be available for the calculation. Two commonly used measures of vehicle usage are vehicle miles traveled and fuel consumed.

As discussed in the remainder of this section and in Section 9, we believe that RSD meets the above requirements reasonably well. However, RSD is not the only test that can be used to characterize fleet emissions. California has considerable experience with random roadside pullover ASM emissions testing. While RSD and roadside ASMs can both be used to characterize fleet emissions, they each have their individual mix of attributes where they excel. In particular, RSD obtains a large number of one half second emissions snapshots of vehicles in a variety of operating modes at a relatively low cost per test. On the other hand, roadside ASM testing acquires 90-second snapshots of emissions on a smaller number of vehicles at a higher cost per test but under controlled operating modes. We have not performed comparative cost-benefit analyses of these two competing methods for this study.

In the subsections below, we examine a few different ways that RSD can be used to evaluate the I/M program and to characterize emissions of the fleet in general.

8.1 Using RSD to Evaluate the I/M Program

For RSD data to be used to evaluate the IM program, it must characterize the emissions of the fleet. RSD takes a snapshot measurement (less than one-second) of a vehicle's exhaust. Much like a photographic portrait taken while the subject is blinking, an RSD measurement may not be a fair representation of the vehicle's normal condition unless it is carefully taken and analyzed.

One question from the objectives of this project is whether remote sensing data can be used to independently verify the emission reductions achieved by Smog Check. Indicating a federal acceptance of this concept is the fact that USEPA has published guidance [5] summarizing three methods to estimate I/M benefits using RSD. The Step Method compares on-road emissions before and after a change in an I/M program. The Comprehensive Method compares on-road emissions as a function of time before and after I/M testing. The Reference Method compares on-road emissions of vehicles in an I/M area with those of vehicles in a non-I/M area.

South Coast I/M change example – As an example of how RSD can be used to help quantify the exhaust emissions reductions of Smog Check we have used the South Coast basin as a test subject. Although it is not representative of the entire state, an ample RSD data set was collected in the South Coast region during the pilot project, so it provides enough data for these types of analyses. About 236,000 readings in the SCAQMD were from vehicles in the appropriate driving mode for this analysis.

We compared fleet-average RSD concentrations from vehicles that have been through the Enhanced Smog Check program to emissions from vehicles that have never been through the Enhanced program such as newly registered vehicles or those registered in Basic I/M areas but driving in the SCAQMD. Figure 8-1 indicates that in the South Coast basin, vehicles that had not yet received an Enhanced Smog Check have higher HC and NOx (especially for light trucks), but the same or lower CO, than vehicles that were measured on-road after an Enhanced Smog Check. By this measure both the cars and trucks seem to have CO emissions relatively unchanged by Enhanced I/M, but the HC and NOx emissions seem to be significantly reduced by the program, especially for the trucks. Since cars and trucks are represented about equally in the fleet, the average of these results is a good approximation of what would be calculated by combining the data of the two vehicle types. The reductions indicated for HC (about an 11% average) and NOx (about a 13% average) are comparable with those presented in the most recent Smog Check Evaluation [6] and we found them to be statistically significant. However, the CO results are quite different. The last Smog Check evaluation by ARB and BAR estimated a statewide, fleet-average reduction of about 14%, while these RSD results indicate no such reduction.

Use of RSD to quality assure analysis methods – Another way RSD can be used to help evaluate the Smog Check program is as an independent means of quality assuring other analysis methods. Results from the pilot study indicate that older vehicles driving past surface street sites are different from older vehicles driving on the freeway. Since a great deal of the benefits of Smog Check come from older vehicles, it is important that this possible difference be investigated.

Figure 8-1. Comparison of SCAQMD cars and trucks not in Smog Check to those having been through Smog Check (up to one-year ago)

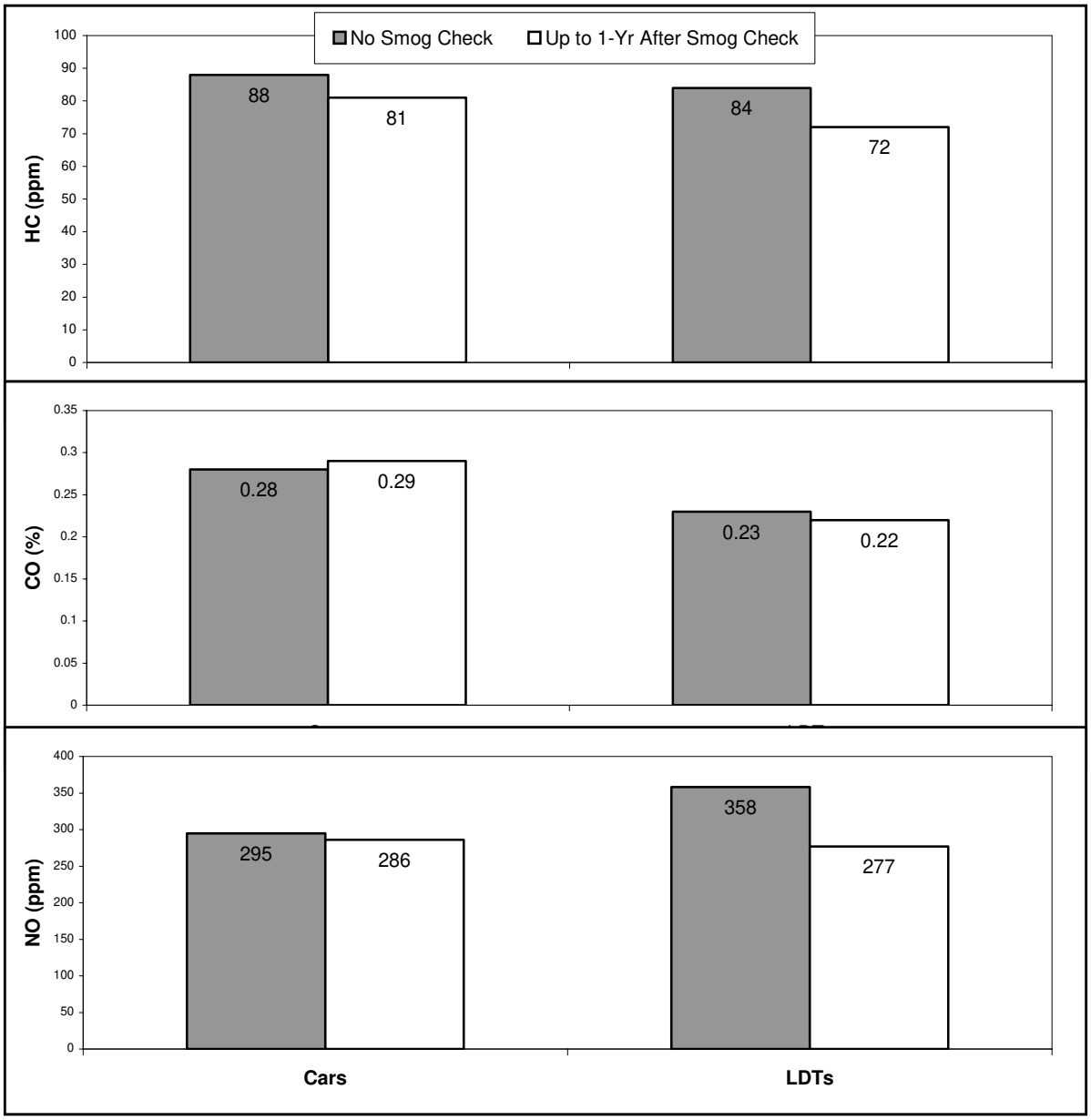
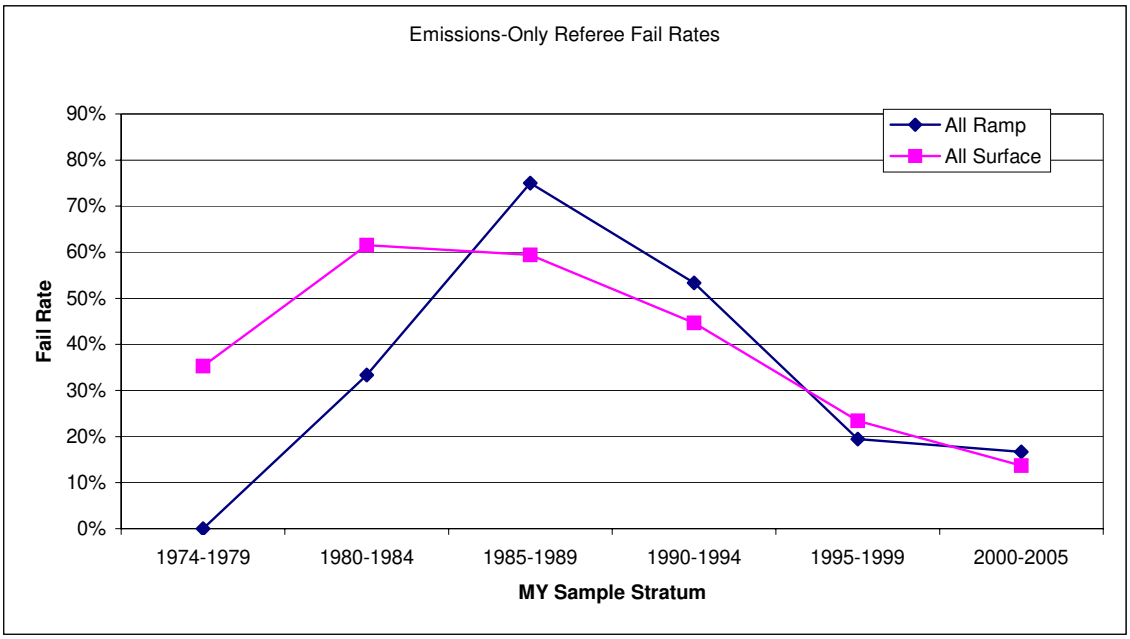


Figure 8-2 shows the average ASM emissions fail rates of vehicles that were observed by RSD at freeway ramp sites and at surface street sites. These fail rates are based on voluntary follow-up I/M tests conducted at referee facilities. In the older model years, the vehicles traveling on freeway ramps have significantly lower average fail rates than vehicles traveling on surface streets. These trends are supported by the RSD data for these vehicles, as the ramp RSD measurements were significantly lower than the surface street measurements. They are also supported by the visual and tampering inspection results in that the older surface street vehicles had much higher overall fail rates than the ramp vehicles, whose overall fail rates were about the same as their emissions-only fail rates. We conclude that, on a model year basis, the average surface street fleet is significantly different than the average freeway ramp fleet.

Another way that RSD might be used to evaluate the I/M program is as an independent means of evaluating I/M station performance, but we did not evaluate this use in this study. If the RSD measurements for vehicles recently certified at a given I/M station revealed that a large fraction of the RSDed vehicles would be expected to fail an ASM test, the station would be suspected of inspection inaccuracies.

Figure 8-2. Emissions-Only Fail Rates, by Model Year Group, of Freeway Ramp and Surface Street Vehicles



Use of RSD to evaluate Smog Check station performance – After a vehicle is certified as passing its emissions inspection, the vehicle should produce emissions concentrations below the I/M cutpoints until an emission control system malfunctions. The performance of an

individual inspection station can be evaluated by measuring the on-road emissions of vehicles that have recently been certified at that station. This requires an on-road measurement method that is independent of the I/M program. BAR has recently performed an analysis (on I/M stations as a group) that demonstrates this technique using Roadside ASMs as the on-road measurement method. However, because it is impractical to perform Roadside ASMs on more than several thousand vehicles each year, Roadside ASM testing probably cannot be used to evaluate each of the hundreds of inspection stations in the I/M program.

RSD measurements may provide an alternative to Roadside ASM testing for evaluating individual inspection stations. One advantage of RSD is that many observations can be made in a year. For example, the 50% any-VSP coverage scenario described in this study would annually produce VSP-qualified RSD measurements on 4,053,388 vehicles subject to I/M (see Table 1-1). For about 4% or 160,000 of these vehicles, the RSDs would be within one month after their certified biennial inspection. A station evaluation would examine the on-road fail rate of the vehicles certified at a station within a short time after they are certified – in this example, one month. Each station's on-road fail rate for vehicles just inspected should ideally be zero. Therefore, the stations that have on-road fail rates closer to zero are better performing than those whose on-road fail rates are significantly greater than zero.

One disadvantage, as we have seen in this study, is that RSD is not particularly well correlated with Roadside ASM measurements (see Figures 9-4 through 9-8). Therefore, an above-normal RSD measurement is not a guarantee that the vehicle will fail an ASM test. On the other hand, when evaluating an inspection station, RSD measurements do not need to perfectly assign vehicles as ASM pass or ASM fail. As long as the RSD measurements can estimate the ASM fail rate of a group of recently certified vehicles with reasonably small uncertainty, the RSD measurements can be used to evaluate the station that certified them.

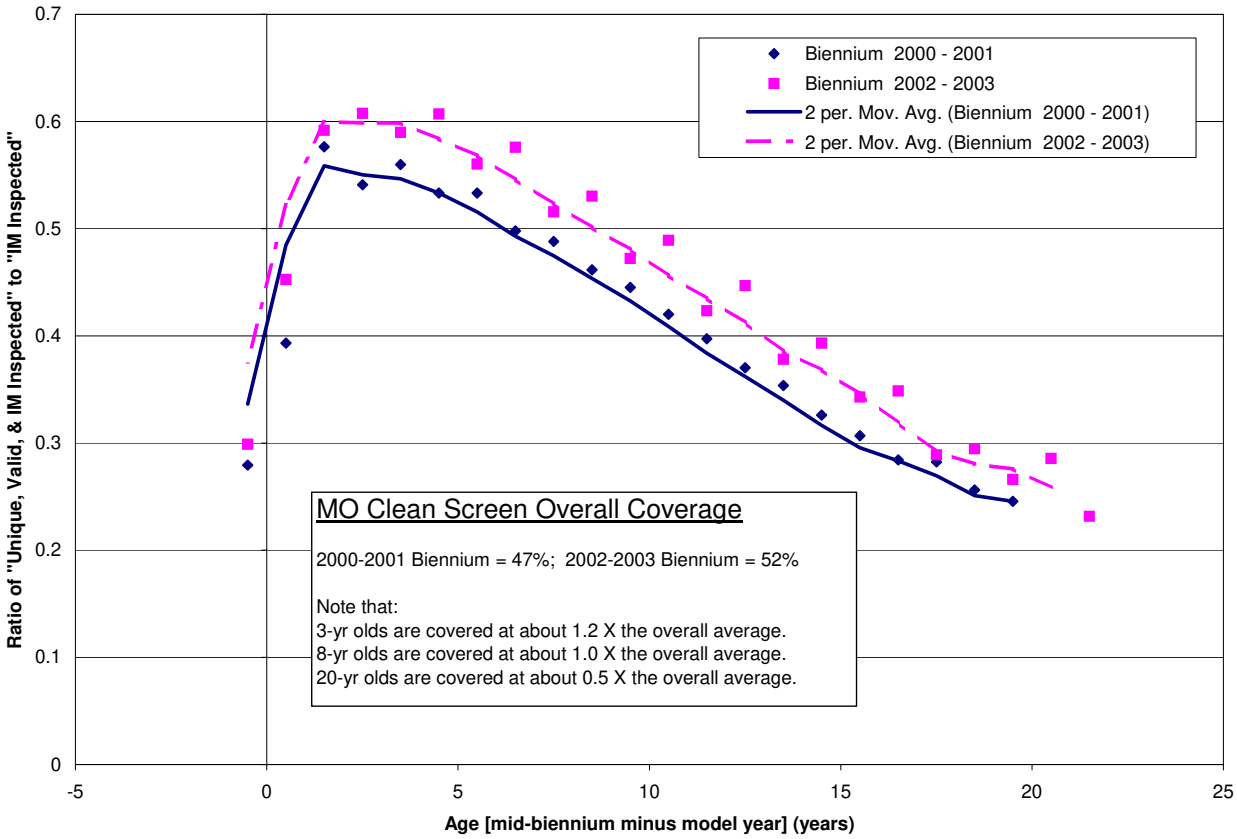
Whether or not the RSD data for vehicles certified at a particular station are able to provide a useful station evaluation probably depends on the details of the set of vehicles. If a station has too few vehicles with RSD measurements, the uncertainty of the station's fail rate calculated from the RSDs will be large. To compare the performances of different stations, the differing model year distributions of the clientele of the stations may need to be accounted for.

8.2 Using RSD to Characterize Fleet Emissions

Determination of age characteristics of the on-road fleet – One benefit of the way RSD is collected (from an analyst's point of view) is that vehicles that are driven the most are also measured the most. Figure 8-3 contains data from the Missouri RSD clean screen program.

The data show the ratio of unique RSDed vehicles that are identified in the I/M data for a particular age to all the vehicles in the I/M data for that age. This is shown for the 2000-2001 and 2002-2003 bienniums. They obtain valid measurements on about half of the fleet that is subject to I/M. But as the curves show, more than half of the new model year vehicles (where the bulk of the fleet and the miles traveled are located) are measured, while less than a third of the oldest vehicles are measured. Unfortunately, the oldest vehicles also pollute the most for every mile they travel, so it is important to collect data on a sufficiently large sample of these vehicles.

Figure 8-3. Variation in RSD Coverage with Vehicle Model Year (from the Missouri Clean Screen Program)
(Data source: Applied Analysis)



Estimation of fleet inventory – As an example of how RSD can be used to characterize the fleet, we estimated the light-duty and medium-duty vehicle exhaust emissions inventory for the South Coast air basin using on-road exhaust emission factors from RSD (i.e., not including cold-start emissions). We used all remote sensing measurements of vehicles registered in the South Coast basin, and two independent sources of vehicle activity: the number of vehicles, average annual miles driven, and average fuel economy, by vehicle type and model year, from

the EMFAC model; and estimated total gasoline use in the South Coast (obtained from fuel tax receipts reported by the California Board of Equalization). Both estimates use the same set of emission factors, from the remote sensing measurements; however, the EMFAC-based estimate is disaggregated by vehicle type and model year, and then summed to obtain the emission inventory, while the fuel-based estimate uses the weighted average gram per gallon emission factors for the on-road fleet, calculated from the RSD data. The fuel-based estimate multiplies the fleet-average gram-per-gallon emission factors by the estimated South Coast fuel consumption (we attributed 41% of statewide fuel consumption to vehicles in the South Coast, based on the South Coast portion of the statewide vehicle miles traveled for light-duty and medium-duty cars and trucks).

Table 8-1 shows the estimated exhaust emission inventory for light-duty and medium-duty vehicles using these two methods. For THC and CO, the fuel-based inventory is almost identical to that estimated using the EMFAC vehicle activity numbers; however, the fuel-based inventory estimates 16% more NOx emissions. Note that the EMFAC-based estimate only accounts for 1972 through 2004 vehicles; including vehicles older or newer than these model years would slightly increase the estimated emissions inventory. The fuel-based emissions inventory does not account for the small fraction of non-gasoline fuel consumption; previous estimates excluded the roughly 3% of fuel sales attributable to non-gasoline fuels. Excluding non-gasoline fuel use would slightly reduce the fuel-based emission inventory.

Table 8-1. Estimated 2004 Inventory for the South Coast Basin, using RSD and Two Sources of Vehicle Activity

Pollutant	Tons per day		Difference between fuel-based and EMFAC-based estimates
	Number of vehicles, vehicle use, and vehicle fuel economy from EMFAC model	Vehicle use from South Coast portion of statewide fuel sales	
THC	143	144	1%
CO	1,478	1,480	0%
NOx	152	177	16%

Table 8-2 compares the fuel consumption based inventory estimated in Table 8-1 with the official 2004 inventory for "hot-stabilized" light-duty and medium-duty vehicles in the South Coast basin. We use hot-stabilized emissions to compare against because in this study RSD was only used to measure exhaust from warmed-up vehicles. Other emissions not measured by RSD (such as cold-start and evaporative emissions) can be a substantial portion of the official inventory, but they are usually not measured by RSD so we do not include them here. For THC the official inventory estimates substantially lower emissions than our estimate (by about 45%),

but for CO and NOx, the official inventory estimate is higher by about 20%. According to research by the University of Denver, fuel consumption based emission inventories from RSD data have an uncertainty in the area of +/-18% for THC, +/-15% for CO and +/-11% for NOx [7]. This indicates that the differences between these predictions are likely to be real and not a result of variability in the data.

Table 8-2. Comparison of RSD Based and Official Inventory for 2004 South Coast Basin

Estimate	Vehicle type	Tons per day		
		THC	CO	NOx
Estimate using remote sensing and South Coast Fuel Sales	Light & Med Cars & Trucks	144 ± 26	1480 ± 20	177 ± 19
Official EMFAC "hot stabilized" emission inventory	Light & Med Cars & Trucks	99.9	1930	213
Difference (EMFAC to RSD/Fuel Based)	Light & Med Cars & Trucks	44%	-23%	-17%

To determine whether the differences originate from assumptions in the RSD based inventory or in EMFAC, or in both, would require some research. Sensitivity analyses of assumptions would help pinpoint important questions for further research. Tracking these differences over a period of years would also help build experience with the RSD based method and help determine whether the method could be improved with changes in assumptions and/or the way the data are analyzed.

Determination of weekday/weekend vehicle emissions distributions – As an example of how RSD can be used to monitor traffic emissions during weekday and weekend travel we again use the South Coast basin as our test case. Figures 8-4 through 8-6 show the average RSD exhaust emissions of on-road vehicles registered in the South Coast basin, by model year, but separated into measurements taken during weekdays (dotted line) and those taken on weekends (solid line). Vehicles measured on weekends have marginally lower or about the same HC and CO emissions as vehicles measured on weekdays. However, vehicles measured on weekends have consistently and significantly lower NOx emissions than vehicles measured on weekdays.

Although it is by no means conclusive, this result seems to validate current thinking on the mechanism behind elevated ozone levels during the weekend. It has been postulated that lower NOx during the weekends leads to higher ozone because of the chemical reaction kinetics of how ozone is formed [8]. Ambient HC/NOx ratio differences can produce conditions that either promote or inhibit the formation of ozone. Lower weekend NOx emissions are speculated

to be due to less commercial (i.e., diesel) traffic and less congestion (i.e., stop and go driving) on the weekends.

Figure 8-4. Average On-Road ppm HC Exhaust Concentrations Of Vehicles Measured On Weekdays And Weekends, By Model Year

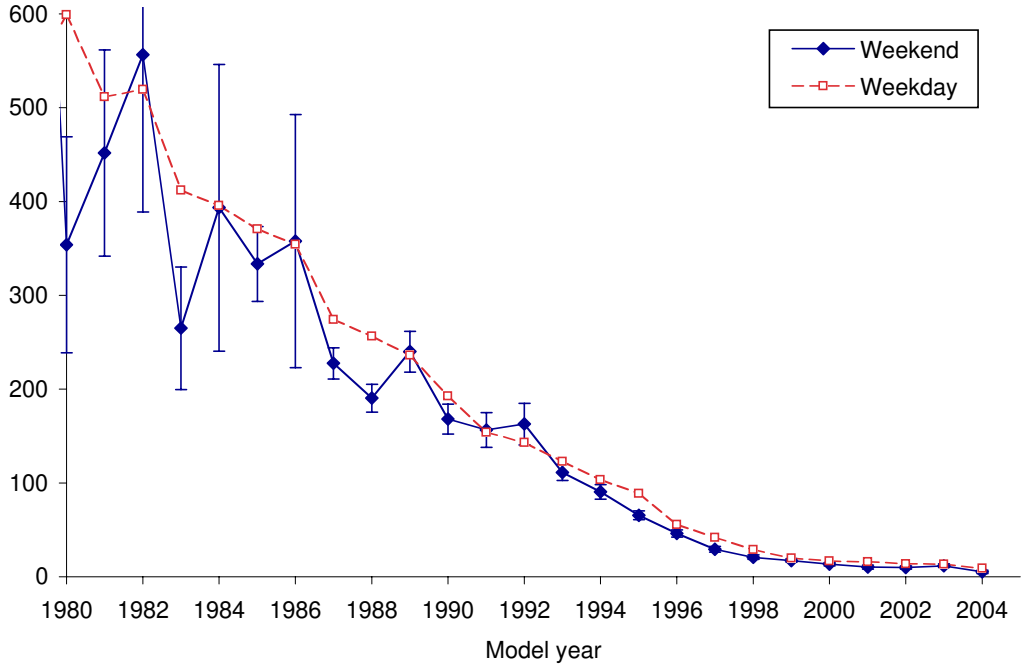


Figure 8-5. Average On-Road % CO Exhaust Concentrations Of Vehicles Measured On Weekdays And Weekends, By Model Year

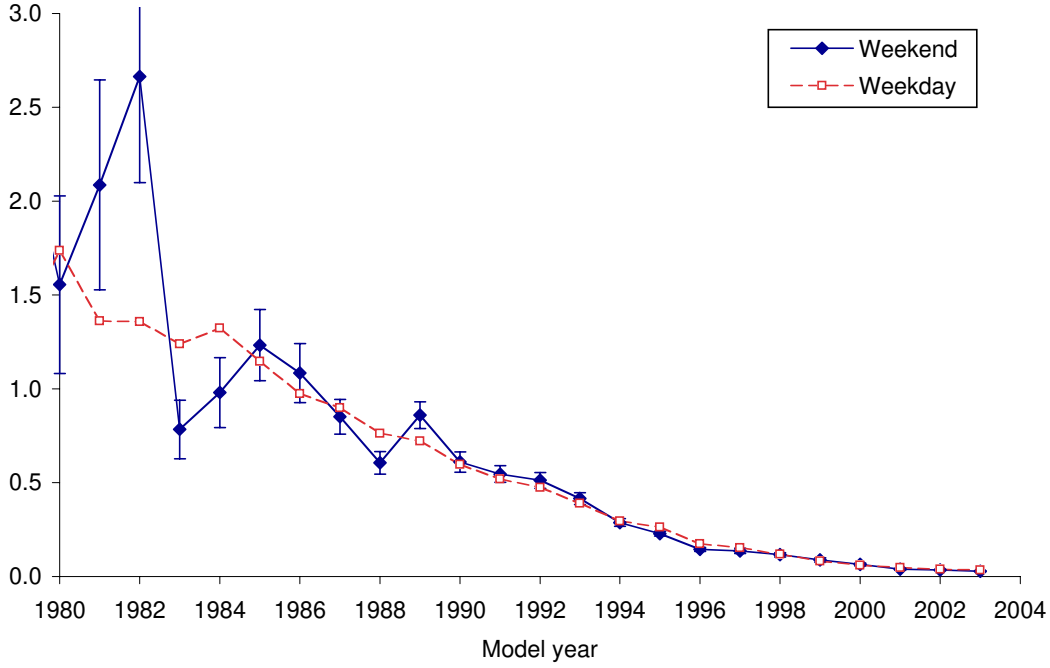
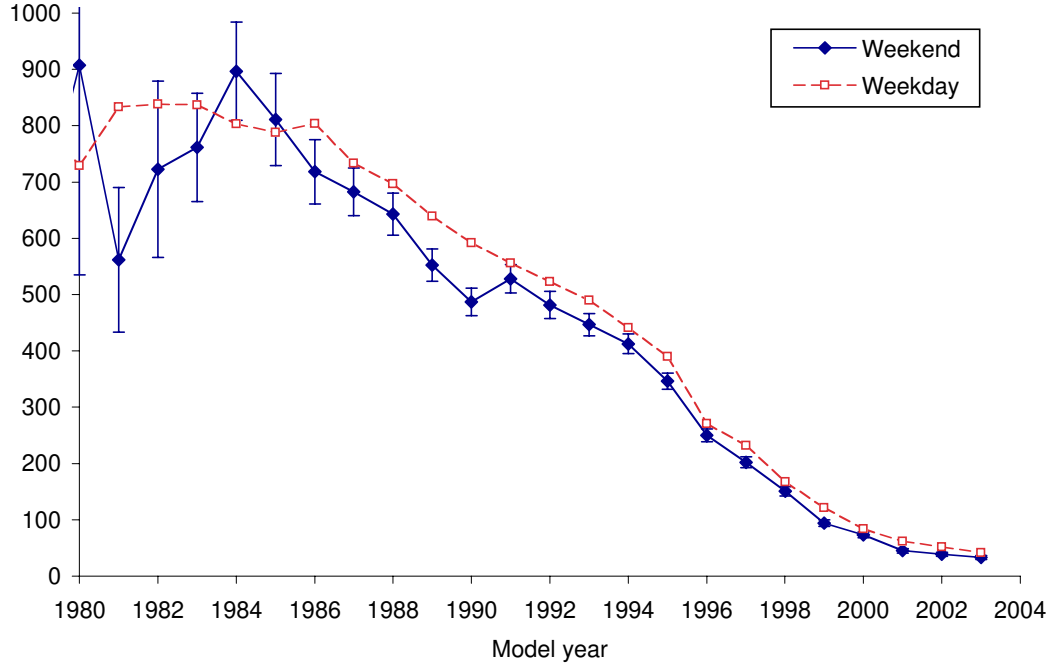


Figure 8-6. Average On-Road ppm NOx Exhaust Concentrations Of Vehicles Measured On Weekdays And Weekends, By Model Year



9.0 Discussion

Our analysis presented in Section 7 indicates that adding an RSD measurement component to the existing California I/M program would not cost-effectively improve strategies that target individual vehicles such as Calling-In, Directing, Exempting, and Scrapping. On the other hand, in Section 8 we found that RSD measurements can be an important source of information to measure the on-road tailpipe emissions of large groups of vehicles in the fleet and subsets of the fleet. On the surface, these conclusions seem to be inconsistent and cause an important question to arise:

Why is RSD not cost-effective for selecting individual vehicles for supplemental I/M strategies, while RSD is effective for measuring the average exhaust emissions of large groups of fleet vehicles?

Based on our experience performing the analyses in this study, it seems that the answer to this question centers primarily around four factors:

1) The inherent temporal emissions variability of each individual vehicle.

2) Use of the I/M station emissions test as a validation of vehicle selection.

3) Low usable-RSD coverage of the statewide I/M fleet.

4) High RSD data collection cost.

Each of the above four factors hurts RSD's ability to effectively and cost-effectively select individual vehicles for special strategies that supplement the existing I/M program. First, for selecting individual vehicles for special strategies, the inherent time-varying emissions of individual vehicles – present even when vehicle operation and environmental factors are constant – cause a poor agreement between on-road RSD emissions measurements and Roadside ASM tests that is performed immediately after the RSD measurements. Other related sources of variability also contribute to the poor correlation. Second, pre-inspection repairs and I/M station measurement inaccuracies can cause further degradation of the relationship between on-road RSD measurements and the in-station ASM tests that would be used to validate selection of vehicles for special strategies. Third, even the largest practical RSD program designed to cover vehicles in the five largest AQMDs would provide only about 30% of the vehicles in the statewide I/M fleet with at least one RSD measurement. Fourth, the loss of usable-RSD information, because of the poor correlation between RSD and the I/M station validation test and because of low I/M fleet coverage, makes the RSD data collection cost to cover the five largest AQMDs high relative to the emissions reduction benefits that can be obtained.

On the other hand, using RSD to characterize fleet emissions is not hampered by any of the four items listed above. Because RSD can sample the emissions of a large group of vehicles at different times, the average of the measurements is close to the average of the inherent emissions of the group of vehicles even though individual vehicles have time-varying emissions. When RSD is used to measure fleet emissions, a validation of emissions measurements by a second test is not required as long as the RSD measurements are unbiased, which can be monitored through regular audits of the RSD instruments. For fleet characterization, it is not necessary to cover the majority of the vehicles in the fleet; only a representative sample of vehicles in the fleet needs to be measured. Finally, the cost of an RSD data collection program of the size needed to adequately characterize the emissions of the fleet does not need to be tremendously high because only a representative sample of the fleet is required.

In this section, we discuss the inherent variability of emissions and issues related to the comparison of two variable measurements (RSD and ASM), and the attributes of RSD that make it good for characterizing fleet emissions and those that make it less effective for incrementally identifying individual vehicles for special strategies.

Section 9.1 discusses and contrasts the sources of variability in emissions measurements when using RSD for individual vehicle selection and when using RSD for fleet characterization. Then, Section 9.2 describes the variability of individual ASM measurements and individual RSD measurements taking into account the time-varying nature of individual vehicle emissions as well as the errors inherent in ASM and RSD instruments. Section 9.3 examines the scattered relationship between RSD measurements and near-simultaneous roadside ASM measurements taken on individual vehicles in this study. The section goes on to compare roadside ASM measurements with subsequent I/M station ASM measurements both at referee I/M stations and regular I/M stations. Section 9.4 discusses fleet coverage by RSD. Section 9.5 goes into more detail in discussing the reasons that RSD was not successful at cost-effectively identifying individual vehicles for special strategies. Finally, Section 9.6 discusses the reasons that RSD is effective at measuring fleet exhaust emissions and evaluating I/M programs.

9.1 Sources of Variability in Emissions Measurements

RSD for individual vehicle selection – In each special strategy, RSD is expected to identify vehicles that are likely to fail an I/M station ASM test and to estimate the mass emissions rate of vehicles at the inspection. When used as a source of information to select individual vehicles for special strategies, RSD is hampered by at least nine sources of variability:

Source 1) The time-varying nature of vehicle emissions,

Source 2) RSD instrumental error,

Source 3) Vehicle operation variability during an RSD emissions test,

Source 4) ASM instrumental error,

Source 5) Vehicle operation variability during an ASM emissions test,

Source 6) Differences in ASM test accuracy among I/M stations,

Source 7) Vehicle pre-inspection repairs between the RSD test and the I/M station ASM test,

Source 8) Differences in the emissions response of a vehicle to RSD and ASM tests,

Source 9) The elapsed time between the RSD test and the ASM test.

We believe that because of the above sources of variability, the RSD measurement loses a large part of its ability to predict individual vehicle ASM results obtained at I/M stations. As a consequence, when used for that purpose, a vehicle's elevated RSD measurement becomes more of an ASM "risk factor" than a guarantor of ASM failure. When used for this purpose, RSD is not much better than any other method, such as VID History, but RSD is more expensive.

We believe that RSD's difficulty in forecasting I/M station ASM failures is not a fault of the RSD test or technique but is a consequence of the sources of variability listed above. Accordingly, we expect that probably no test – not ASM, not IM240, and not even FTP – could forecast I/M station ASM failures of individual vehicles with the accuracy needed to significantly improve upon predictions made by the VID-alone.

RSD for fleet characterization – However, when RSD measurements are used to characterize the fleet or evaluate the I/M program, the situation is entirely different. The RSD technique was originally designed to measure the on-road emissions of vehicles – not to forecast the I/M station emissions results of individual vehicles. For fleet characterization, RSD is used to determine, through averaging, the average on-road emissions of large groups of vehicles, and in this situation only the first three sources of variability apply:

Source 1) The time-varying nature of vehicle emissions,

Source 2) RSD instrumental error, and

Source 3) Vehicle operation variability during an RSD emissions test.

The other five sources of variability (Sources 4 through 8) go away because they relate to ASM measurements. When RSD is used to characterize the on-road emissions of the fleet, the ASM results that might be obtained are not relevant.

When large numbers of RSD measurements are taken, the averages of the measurements have relatively small errors. With proper RSD data collection and analysis, California can obtain valuable information for characterizing the on-road emissions of sub-fleets. This information can be used to independently evaluate the I/M program or can be used for a variety of other uses, for example, to evaluate I/M station performance.

9.2 Variability of Individual ASM and RSD Measurements

While the measurement error of emissions instrumentation and variations in the emissions test procedure contribute to the variability in the measured emissions value, a main cause of the variability in measured emissions is the inherent variability of the "true" emissions of the vehicle (Source 1). The true emissions of an individual vehicle vary widely with time as a result of changes in vehicle driving mode, fuel and environmental factors, and the internal operation of the engine and emission control systems. Because of this underlying variability in the true emissions of the vehicle, subsequent measurements of the emissions of the same vehicle, even by the same type of test, will vary considerably. In this subsection, we provide evidence to quantify instrumental and procedural variability of ASM and RSD emissions and vehicle emissions variability.

Measurement Variability of ASM and RSD Instruments – ASM instrumental variability (Source 4) and RSD instrumental variability (Source 2) affect the ability of RSD to predict I/M station ASM results. ASM and RSD instrument manufacturers publish specifications that define the variability of measurements produced by their instruments in a dry gas audit situation. These specifications are intended to quantify the inaccuracies and uncertainties associated with just the instrumental measurement process itself. That is, the specs do not include any sources of variability that arise from the vehicle or vehicle exhaust.

Table 9-1 gives the acceptance test criteria for the measurement of ASM emissions in the BAR-97 Instrument Emissions Inspection System Specifications. These values provide an idea of the uncertainty when dry cylinder gas is measured with the instrument.

Table 9-1. Acceptance Criteria for ASM Concentration Measurements

C_6H_{14} ± 5ppm or ± 3.40% of reading, whichever is greater
CO ± 0.03% or ± 3.32% of reading, whichever is greater
NO ± 27ppm or ± 4.25% of reading, whichever is greater

Table 9-2 gives the relative accuracy specification given by the manufacturer for ESP's Accuscan RSD4000 instrument, which was used in this pilot study. These RSD specifications apply to dry gas audit conditions, that is, when the RSD instrument is measuring a simulated dry gas stream, which is created by cylinder gases emitted from the simulated tailpipe of a moving audit gas truck.

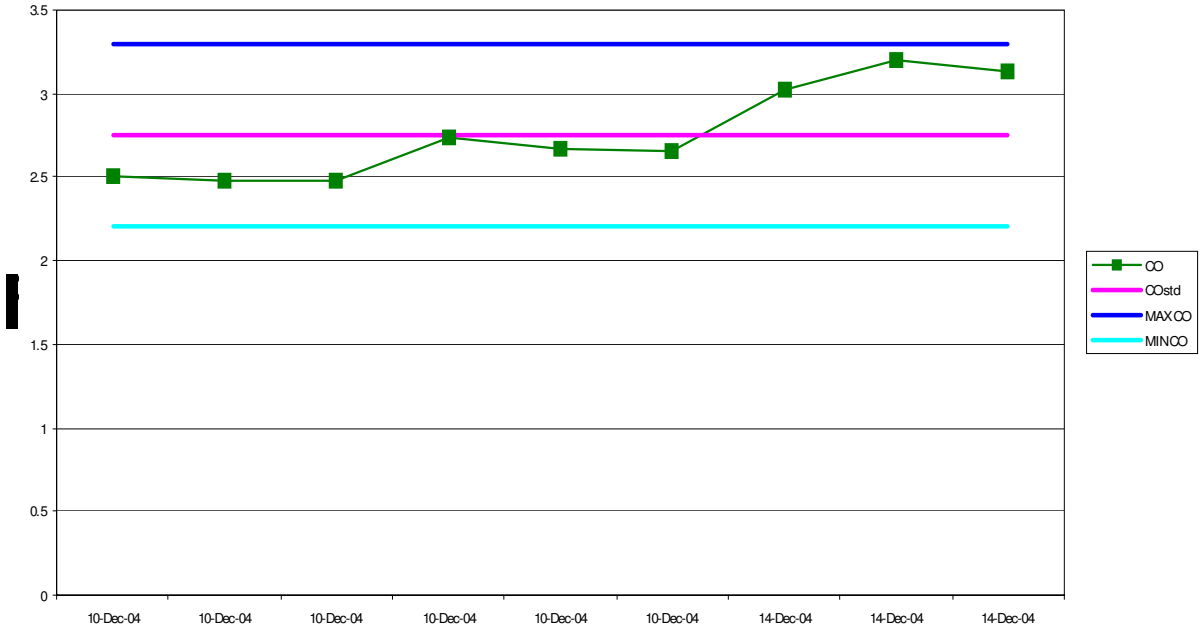
Table 9-2. Relative Accuracy for the Accuscan RSD4000 Instrument

The performance of the RSD4000 product will meet or exceed the following absolute and relative accuracy specifications:
C_3H_8 ± 100ppm or ± 10% of reading, whichever is greater
CO ± 0.1% or ± 10% of reading, whichever is greater
NO ± 150ppm or ± 10% of reading, whichever is greater
Static background conditions and mean value of CO_2 plume < 20 %-cm:
C_3H_8 ± 150ppm or ± 15% of reading, whichever is greater
CO ± 0.15% or ± 15% of reading, whichever is greater
NO ± 225ppm or ± 15% of reading, whichever is greater

A comparison of the values in Table 9-1 and 9-2 shows that the RSD instrument has a variability about three times as large as the ASM instrument at high values and from three to ten times as large as the ASM instrument at concentrations near zero. This difference in relative accuracy between the ASM and RSD instruments is not too surprising given that RSD measures a gas plume remotely with a beam of light while ASM measures by aspirating a sample of exhaust gas into the instrument.

During the field collection of RSD data, a dry gas audit truck was used to periodically check the RSD instruments. Examination of these audit results indicated that the variability of the RSD instruments was within the instrument specification. Figure 9-1 shows an example for a mixture containing 2.8% CO. For this concentration, BAR's requirement for RSD equipment is ±20% of the reading, as indicated by the upper and lower limits on the plot. All readings were within these limits and are also within the manufacturers specifications of ±15%.

Figure 9-1. Actual Vs. Measured CO Concentration for RSD Unit # 4503 and Cylinder "E"

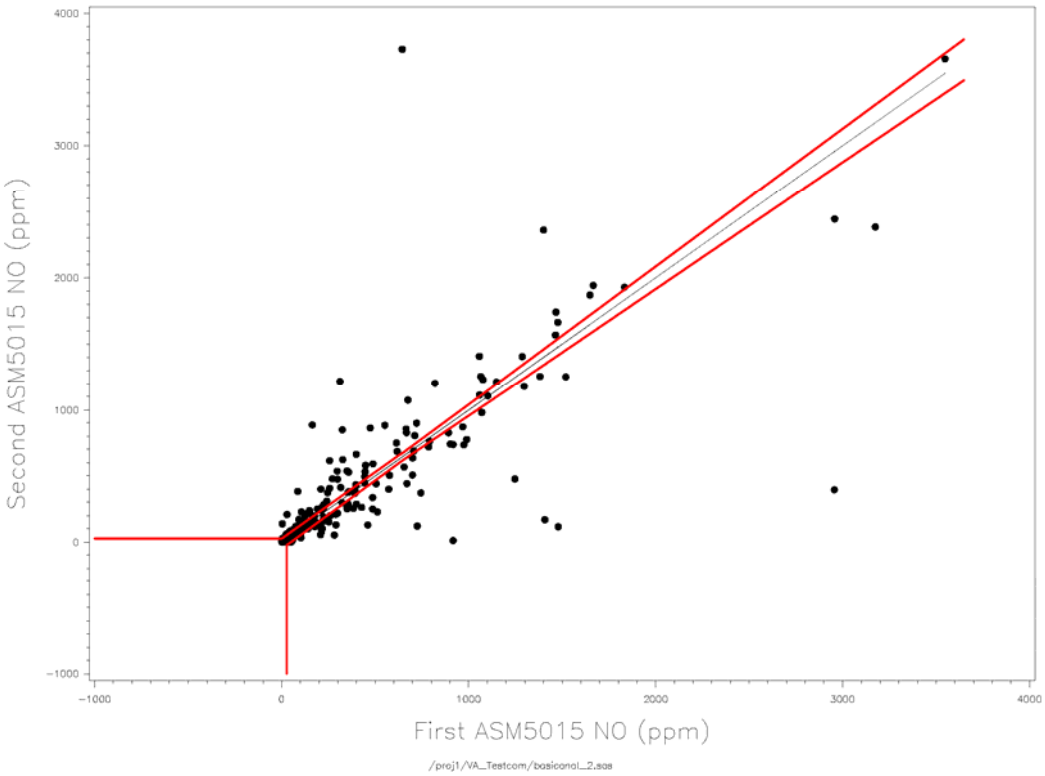


Variability of Vehicle Emissions– Another source of variability of the measured emissions concentration values is the time variability of the vehicle emissions themselves (Source 1). If we could measure the true instantaneous emissions concentration of a vehicle, even at constant operating conditions, we would see that the emissions are constantly changing with time. RSD measurements have an added source of variability (Source 3) because a range of operating conditions ($5 < VSP < 25$ kW/Mg) is acceptable. Even though ASM tests are performed at a nominally constant operating condition, small procedural variations in speed always occur (Source 5). As a result, an RSD measurement is a 0.5s snapshot and an ASM is a 90s snapshot of the vehicle's time-varying emissions. Even for the same vehicle, two or more ASM snapshots will not be exactly the same, nor will two or more RSD snapshots. Nevertheless, those tests do provide a general "idea" of the emissions of the vehicle.

To get an idea of the size of vehicle emissions variability (Source 1), we can examine repeat tests on vehicles. As an example, Figure 9-2 shows repeat ASM5015 NO values from a study that ERG performed for the Virginia Department of Environmental Quality in 2002 [9]. Each point shows the measurements from two separate emissions tests. In that study, TESTCOM made duplicate ASM measurements of 197 New York state light-duty vehicles using a stratified random sampling design by model year group and vehicle type. Ideally, the duplicate measurements would fall exactly on the 1:1 line on the plot. However, the points do not fall on

the 1:1 line because of three sources of variability: the inherent time variability of vehicle emissions (Source 1), the variability of vehicle operation during the ASM test (Source 5), such as small deviations in vehicle speed, and variability in the measurements from the ASM instruments (Source 4). The area inside the red lines defines the acceptance criteria for the ASM instrument, which are taken from Table 9-1. These limits determine the estimated variability of ASM instruments (Source 4). Most of the data points are outside of this area; we attribute this to the inherent time variability of vehicle emissions (Source 1) and the ASM procedural variability (Source 5).

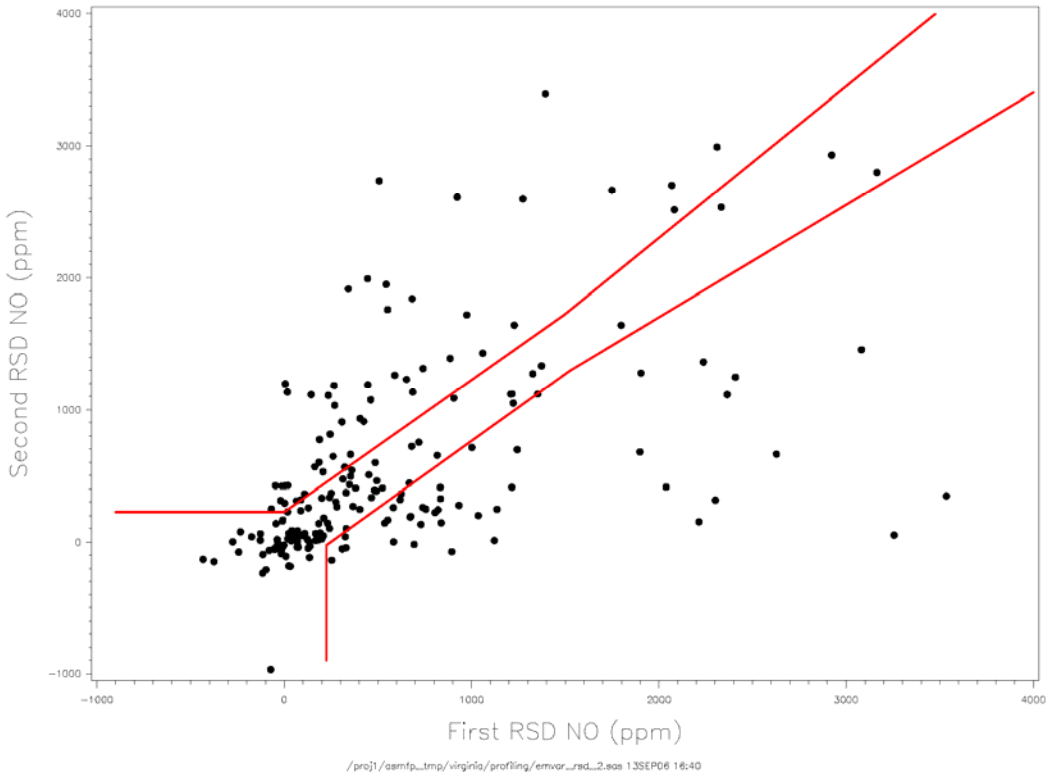
Figure 9-2. Replicate Measurements of ASM5015 NO on 197 New York Vehicles



Virginia also performed an RSD pilot study. As part of the California pilot study, ERG obtained RSD values from the Virginia pilot study's dataset and found about 20,000 pairs of in-VSP-range RSD measurements taken less than two days apart on the same vehicle by the same RSD instrument. We randomly selected 197 observations of this dataset so that the model year distribution was the same as that of the New York State vehicles shown in Figure 9-2. Figure 9-3 shows the repeat RSD NO (ppm) values of these vehicles with the estimated variability of the RSD instrument, which was taken from Table 9-2, shown by the red lines. Many of the data points are outside of the red lines. Again, points will fall outside of the red lines because of the inherent time variability of vehicle emissions (Source 1) and because of RSD vehicle operation

variability (Source 2), which arises from the variation of vehicle specific power (VSP) within the acceptable range of 5 to 25 kW/Mg.

Figure 9-3. Replicate Measurements of RSD NO on 197 Virginia Vehicles



We can examine the figures to determine the fraction of observations that fall within the instrumental variability specifications. If vehicles had no emissions variability, about 95% of the data points would fall within the red-line limits. Analysis of the data near zero emissions indicates that many of the data points fall within instrumental variability. This tends to confirm the instrumental variability specs near zero emissions for the RSD and ASM instruments since the emissions of very clean vehicles generally do not vary by large amounts. Therefore, the only significant source of variability of the measurements for very clean vehicles is the instrumental variability itself since there are no emissions to vary. The plots show that for emissions greater than zero, most data points fall outside of the instrumental variability specs for both types of instruments. This indicates that vehicle emissions variability is larger than instrumental variability.

We believe the main reason that most of the points in Figures 9-2 and 9-3 are outside of the red-lined areas is vehicle emissions variability. However, there can be additional reasons. This is hinted at by the figures showing that the RSD values are substantially farther away from

the 1:1 line than the ASM values are. This could be caused by differences in the time between the replicate tests. ASM tests were done sequentially; RSD tests were done no more than two days apart. Alternatively, the ASM data points may be closer to the 1:1 line in comparison to the RSD data points because of the longer duration of the ASM test vs. the RSD test (90s vs. 0.5s). Longer duration tests could produce results with lower variability.

In any case, the duplicate values in Figures 9-2 and 9-3 show that, for both ASM and RSD, vehicles routinely produce emission values that vary substantially. A comparison of the figures indicates that the RSD measurements are less able to repeat themselves than the ASM measurements are. Through a comparison of this repeat measurement variability with the instrumental variability specifications, we conclude that the sum of the time variability of vehicle emissions (Source 1) and the test procedural variability (Sources 3 and 5) is substantially larger than the instrumental variability (Sources 2 and 4).

9.3 Variability of RSD Values with ASM Values for Individual Vehicles

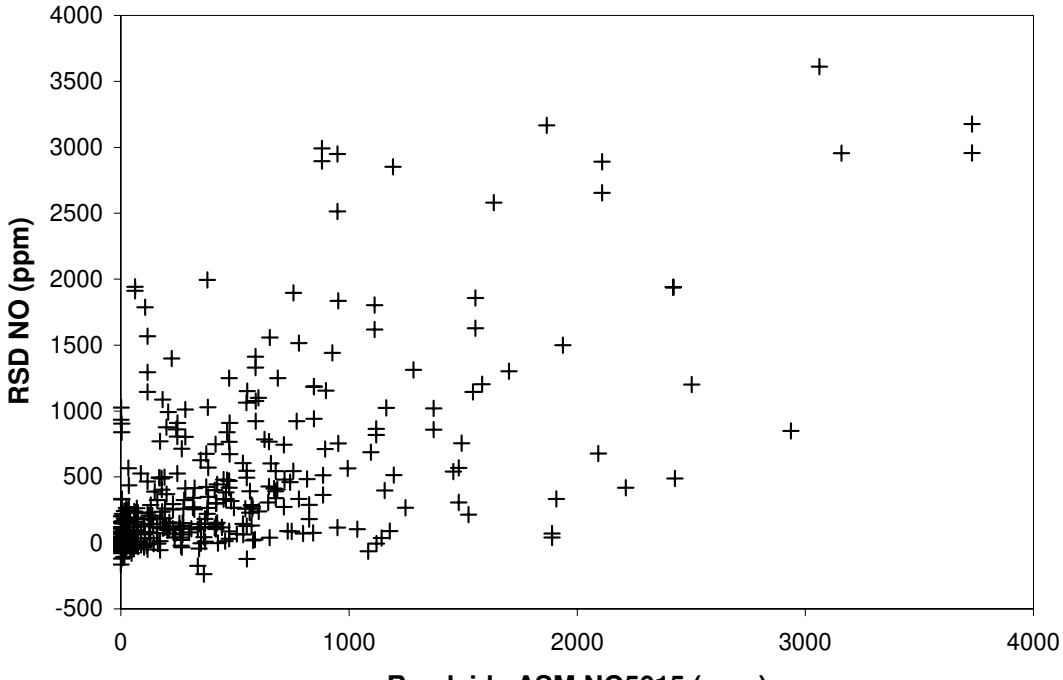
In this study we want to use RSD measurements to predict I/M station ASM results since passing or failing the I/M station ASM emissions test is one of the important factors in evaluating the different special strategies. The I/M station ASM emissions test is the reference test for validating individual vehicle selection for a special strategy. Specifically, for Calling-In, Directing, and Scrapping, if the selected vehicle does not fail the I/M station ASM test that follows the RSD, the vehicle's selection will be viewed as inappropriate. Therefore, we need to investigate the I/M station ASM-prediction ability of RSD. We can do this by looking at RSD/ASM pairs. In the discussion below, we first compare emissions measurements of RSD and Roadside ASMs that were taken nearly simultaneously. Then, we examine the effects of the pre-inspection repair and I/M station performance by comparing Roadside ASMs and Referee ASM results and by comparing Roadside ASMs and regular I/M station ASM results.

Comparison of RSD and Roadside ASM Measurement Pairs – The ability of RSD to predict ASM can be evaluated using the paired RSD and Roadside ASM data collected in this study. Vehicles were randomly given a Roadside ASM within minutes of receiving a standard RSD measurement. Vehicles were selected with a stratified random sampling plan based on model year group and vehicle type and not the RSD measurements. After filtering for in-range vehicle specific power during the RSD measurements, 416 vehicles remained in the dataset.

Figure 9-4 shows a plot of the RSD NO vs. the ASM5015 NO for the 416 vehicles. The plot shows an unmistakable, though highly scattered, relationship between the RSD and the Roadside ASM5015 NO measured values. The scatter is caused by the RSD instrumental error

(Source 2), VSP variability during the RSD test (Source 3), ASM instrumental error (Source 4), vehicle operation variability during the ASM test (Source 5), time variability of the vehicle emissions (Source 1) plus the difference in responses of individual vehicles to ASM and RSD tests (Source 8). Clearly, the plot demonstrates that RSD will have some ability to predict Roadside ASM results. However, the wide scatter of the points is troublesome if we want to use an individual vehicle's RSD measurements to predict its I/M station ASM results. For example, if the RSD NO measurement were 1000 ppm, the Roadside ASM5015 NO could be anywhere between 0 and 3000 ppm. The I/M station ASM5015 NO could be anywhere over an even wider range because of additional variability from Sources 6 and 7.

Figure 9-4. Comparison of NO Concentrations Measured by RSD then Immediate Roadside ASM



/proj1/DecisionModel/Report/RSD-RASM-DataForTHD_1_VSPinRange_1.xls

The ASM5015 NO inspections for the data plotted in Figure 9-4 had ASM cutpoints ranging from 360 to 1600 ppm. Because a wide range in technologies could explain part of the scatter in Figure 9-4, we separated the data into groups with similar ASM5015 NO cutpoints. When we examined the large set of recent ASM inspections in the VID, we found that the ASM5015 NO cutpoints, which were all in Phase 4.3, fell into four distinct bands defined by the groupings of the emissions standards categories (ESC) shown in Table 9-3. The table gives the range of cutpoints and the median cutpoint of each group. Splitting the data in Figure 9-4 into the

four groups of ESCs produces Figures 9-5, 9-6, 9-7, and 9-8. The plots all have the same scales. The vertical line on each plot, which designates the median cutpoint, is different for each plot. Points to the right of the cutpoint line represent Roadside ASM5015 NO fails. All four figures show scatter that is somewhat less than the scatter in Figure 9-4, but each still has substantial scatter. The consequence of the scatter is that it prevents RSD from being able to effectively predict the Roadside ASM5015 pass/fail result.

Table 9-3. Groups of ASM5015 NO Cutpoints

Phase 4.3 Emission Standards Category	Model Year / Vehicle Type		ASM5015 NO Cutpoint (ppm)	
			Range	Median
2, 10, 11, 18, 19	75-80 PC	75-83 LDT	1220 - 1600	1440
3, 4, 12, 13, 20, 21	81-86 PC	84-92 LDT	940 - 1220	1000
5, 6	87-95 PC		640 - 940	760
7, 8, 9, 14, 15, 16, 17, 22, 23, 24, 25	96-04 PC	93-04 LDT	360 - 640	480

For example, consider Figure 9-6, which shows the results for 103 vehicles. If we apply the median ASM5015 NO cutpoint of 1000 ppm, the plot shows that 15 of the vehicles would fail and 88 would pass the ASM5015 NO test. (That is, 15 are to the right and 88 are to the left of the vertical cutpoint line.) We would like RSD to be able to distinguish these 15 ASM failers from the 88 ASM passers. The plot shows that this is not going to be possible. We can imagine a horizontal RSD NO cutpoint line running across the scatter plot. It divides the plot into four quadrants. For example, if we apply an RSD NO cutpoint of 1000 ppm, the plot shows that 15 of the vehicles would have RSD NOs above 1000 ppm and would be designated failers, and 88 of the vehicles would have RSD NOs below 10000 ppm and would be designated passers.

For the 103 vehicles, the fail rates for RSD NO and ASM5015 NO using 1000 ppm cutpoints are both 14%. However, a simple comparison of fail rates is misleading because it gives the impression that RSD can accurately predict ASM. To properly evaluate the ability of RSD (or any test) to properly predict the ASM pass/fail result, we always need to examine all four quadrants. Table 9-4 gives the four quadrant performance for this situation. RSD NO correctly designates 80 ASM5015 NO passers and 7 ASM5015 NO failers; however, RSD incorrectly designates the 16 other vehicles in the other two quadrants. Thus, we see that while RSD gets the fail rate correct, it makes errors in classifying individual vehicles.

Figure 9-5. NO Concentrations Measured by RSD and ASM for 75-80 PCs + 75-83 LDTs

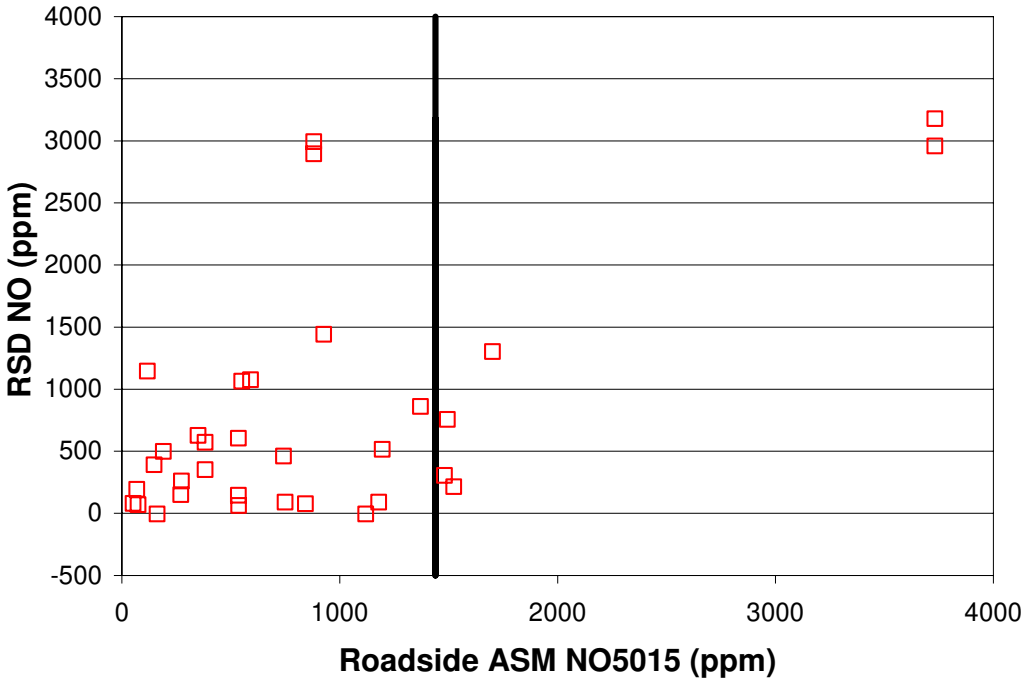


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Figure 9-6. NO Concentrations Measured by RSD and ASM for 81-86 PCs + 84-92 LDTs

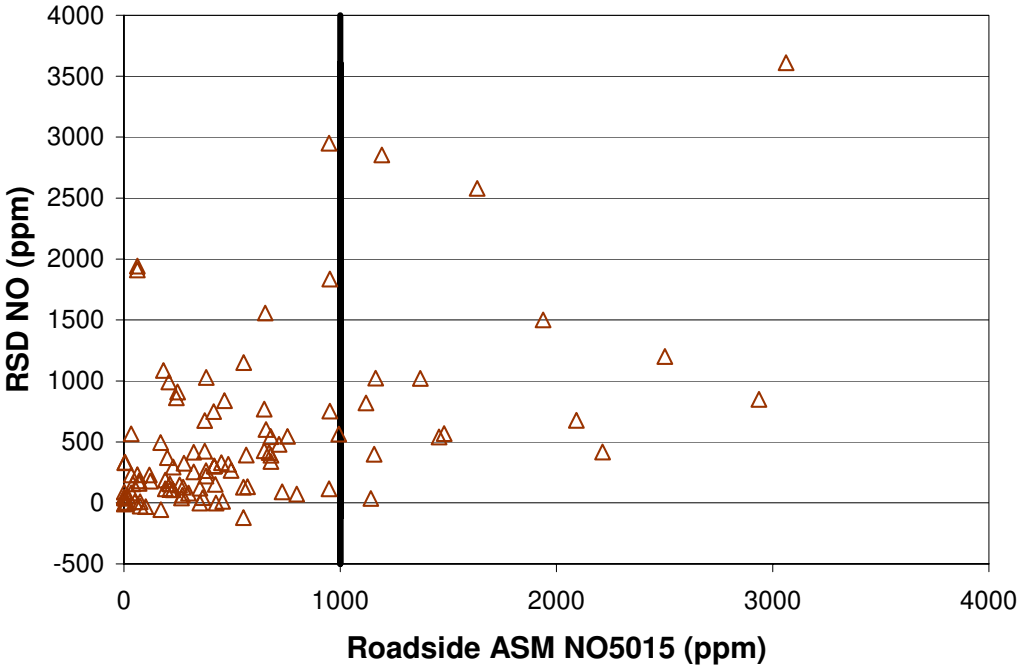

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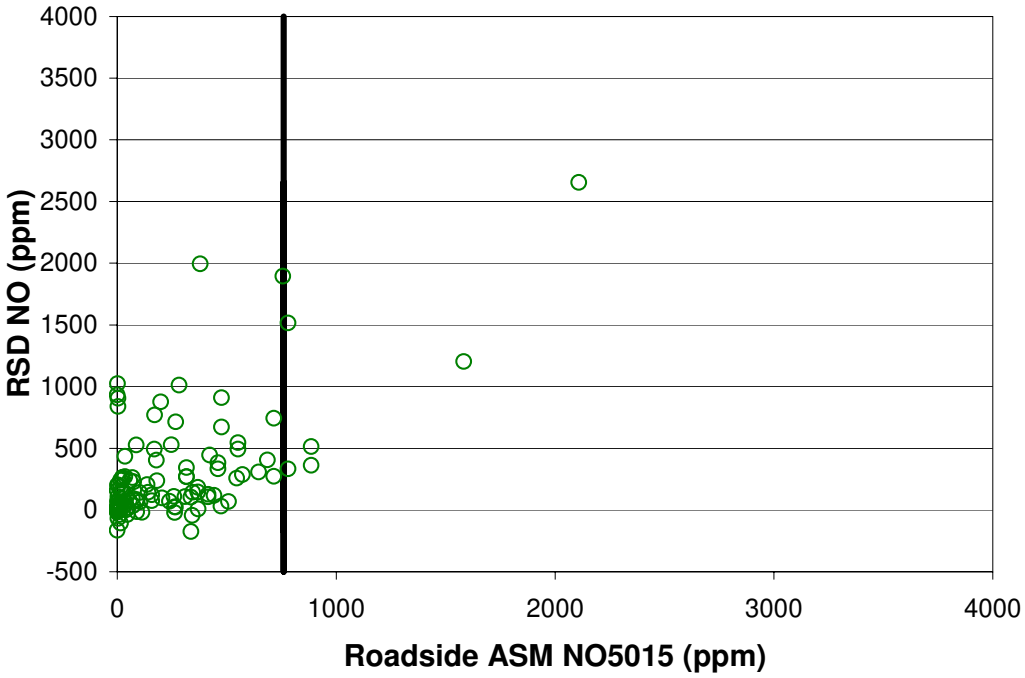
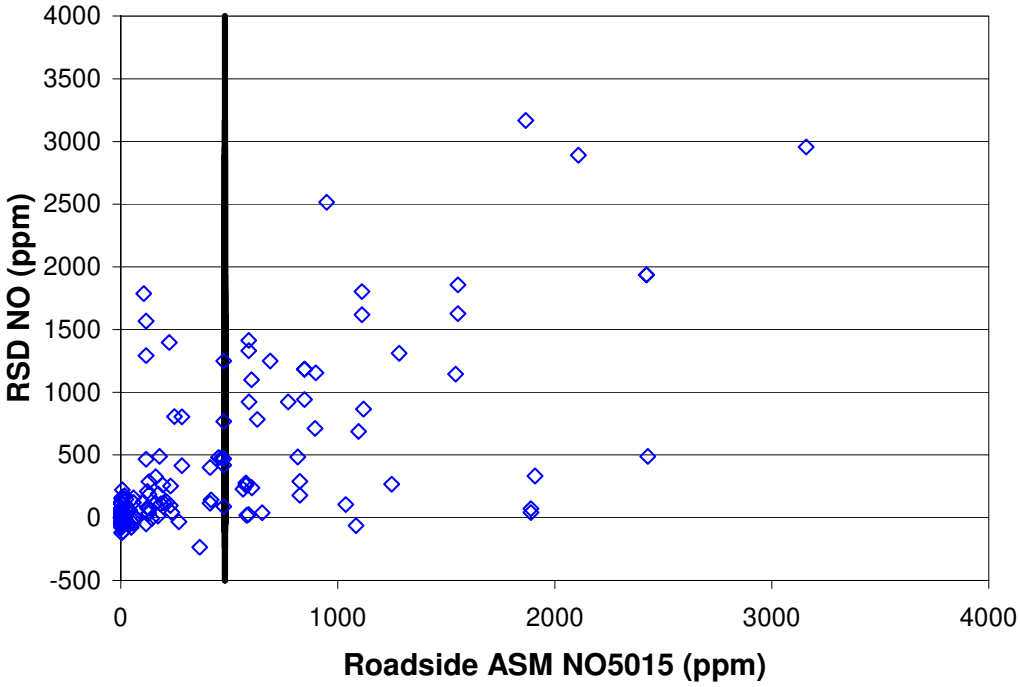
Figure 9-7. NO Concentrations Measured by RSD and ASM for 87-95 PCs



/proj1/DecisionModel/Report/RSD-RASM-DataForTHD_1_VSPinRange_1.xls

Figure 9-8. NO Concentrations Measured by RSD and ASM for 96-04 PCs + 93-04 LDTs



/proj1/DecisionModel/Report/RSD-RASM-DataForTHD_1_VSPinRange_1.xls

Table 9-4. ASM-Prediction Performance for an RSD Cutpoint at 1000 ppm for 81-86 PCs and 84-92 LDTs Data

		ASM5015 NO Result (1000 ppm cutpoint)			
		Pass	**Fail**	**Total for RSD NO**	
RSD NO Result (1000 ppm cutpoint)	**Fail**	8	7	15	14%
	Pass	80	8	88	
	Total for Roadside ASM5015 NO	88	15	103	
			14%		

By looking at Figure 9-6, as well as Figures 9-5, 9-7, and 9-8, we can see that no matter where the RSD cutpoint line is located, RSD will always either miss some ASM-failing vehicles in the lower right quadrant or will improperly designate passing vehicles in the upper left quadrant. Setting the RSD cutpoint at a high value such as 3000 ppm to assure that all of the selected vehicles would fail the ASM test is not an effective approach since the other 14 (non-selected) vehicles (in the lower right quadrant) that also fail the ASM would still be left on the road to excessively emit.

It is the scatter in the RSD vs. ASM measured values that causes the poor ability of RSD to predict Roadside ASM results. Why is there such large scatter? Earlier we discussed some of the sources of variability in RSD and ASM individually; however, when we compare RSD results with Roadside ASM results, as we do in Figures 9-4, 9-5, 9-6, 9-7, and 9-8, a new source of variability enters the problem: A vehicle responds differently to different tests (Source 8). If the predictor test (RSD, in this case) is different from the I/M inspection test (ASM), the two emissions results for a given vehicle will not have the same value – even though both measure tailpipe concentrations – because the two tests measure the vehicle at two different operating conditions using different procedures. In addition, the difference in response to ASM and RSD is different for different individual vehicles. Overall, the scatter in Figures 9-4, 9-5, 9-6, 9-7, and 9-8 is produced by four contributions: the relatively small contributions of RSD measurement variability and ASM measurement variability, the large inherent emissions variability of the vehicle, and the difference in responses of the vehicle to the RSD and the ASM tests.

Comparison of Roadside ASM Measurements and I/M Station ASM Measurements – The discussion above compared RSD measurements with Roadside ASM measurements. However, RSD must be able to predict the ASM result taken at an I/M station if it is to be used for a special strategy. It is possible that some vehicle owners get vehicles repaired in the few

days before they get an I/M station ASM inspection because failing the ASM test has consequences. If these so-called pre-inspection repairs occur, they are beneficial to the I/M program, but they further hinder the ability of RSD measurements to predict I/M station ASM results for individual vehicles. As discussed below, whether the I/M station ASM test has consequences or not affects the connection between Roadside ASM result and I/M station ASM result.

In the study, after drivers received the Roadside ASM, they were offered $50 worth of gasoline if they would go to a Referee station to get a follow-up ASM test. They were told that there would be no consequences to the Referee station test. That is, if they failed the test they would not be required to get repairs. Of the 1,113 vehicles that we made the offer to, 60 ultimately had a Referee ASM performed. The four-quadrant comparison of the Roadside ASM and Referee results is given in Table 9-5. The table shows that while 33% of the 60 vehicles failed the Roadside ASM, 45% failed the Referee ASM. We believe that the quality of Roadside ASMs and Referee ASMs are comparable; therefore, the significant difference[21] between the fail rates may be a consequence of the fact that all Referee ASMs occurred a period of time after the Roadside ASMs.

Table 9-5. Comparison of Roadside ASM and Referee I/M Station ASM Results

		Referee Station Result			
		Pass	**Fail**	**Total for Roadside ASM**	
Roadside ASM Result	**Fail**	3	17	20	33%
	Pass	32	8	40	
	Total for Referee Stations	35	25	60	
			45%		

The other important feature of Table 9-5 is that 18% (= (3+8)/60) of the vehicles received different ASM pass/fail results for the roadside and referee tests. We believe that this is largely due to vehicle emissions variability and is consistent with the ASM repeatability results shown in Figure 9-2. Too often we think of an ASM test result as the answer for a vehicle, and we forget that emissions variability can cause a vehicle to pass one ASM and shortly thereafter fail the next.

Also in the study, many of the 1,113 vehicles that received a Roadside ASM later received an ASM test as part of their normal participation in the I/M program. At the time of this

[21] Both fail rates for this dataset of 60 observations have 95% confidence limits of ±12%. Therefore, the 95% confidence intervals are 21% to 45% for the Roadside ASM fail rate and 32% to 57% for the Referee ASM fail rate.

analysis we found VID records for 174 of these vehicles. The four-quadrant comparison of the Roadside ASM and regular I/M Station results that followed are shown in Table 9-6. The table shows that while 53% of these vehicles failed the Roadside ASM, only 27% failed the regular I/M station ASM. We have seen this factor of two difference between Roadside ASM and I/M station fail rates in previous studies. In this situation, it can be caused by several factors including: 1) pre-inspection repairs before regular I/M inspections, or 2) inaccuracy at regular I/M stations. Whatever the reasons for the difference in fail rates, they cause a further decoupling of on-road emissions characteristics (as measured by Roadside ASM and RSD) from I/M station ASM measurements.

The four-quadrant analysis of Table 9-6 also shows that 35% (= (53+8)/174) of the vehicles received different results for the Roadside ASM and regular I/M station tests.

Table 9-6. Comparison of Roadside ASM and Regular I/M Station ASM Results

		Regular I/M Station Result			
		Pass	**Fail**	**Total for Roadside ASM**	
Roadside ASM Result	**Fail**	53	39	92	53%
	Pass	74	8	82	
	Total for Regular Stations	127	47	174	
			27%		

Summary – The fact that individual vehicle emissions vary with time, that a vehicle responds differently to RSD and ASM tests, that vehicles may receive pre-inspection repairs between the RSD and the "official" I/M station ASM test, and that regular I/M stations have inaccuracies means that the connection between RSD concentration values and the ASM concentration values will be loose. Thus, an RSD measurement[22] of a vehicle's emissions will be an imperfect predictor of the vehicle's ASM emissions and ASM emissions pass/fail result at I/M inspection. Nevertheless, by convention, the "correctness" of the selection of the vehicle is judged by a single I/M-station inspection ASM test result. Any lack of correctness is blamed entirely on the predictor test, in this case the RSD test, even though the sources of incorrectness[23] come from the ASM test and vehicle emissions variability in addition to the RSD test.

[22] We need to keep in mind that this conclusion is not dependent on the fact that the predictor test is an RSD measurement. It is not that RSD measurements have bad qualities. All types of predictor tests – a roadside ASM, a roadside IM240, an I/M station pre-test ASM, or even the venerable FTP – will be imperfect predictors of the official I/M inspection ASM result.

[23] The sources of incorrectness are the variability of the "true" emissions of the vehicle, the RSD instrumental measurement error, the RSD procedural errors, the ASM instrumental measurement error, the ASM procedural

Because RSD is a measurement, the casual observer thinks, "With RSD I can find the high-emitting vehicles and fix them." However, in an existing I/M program it is not as simple as that. The selected vehicle must fail the I/M station ASM test before repairs are required. Because of all of the sources of variability that are involved in using RSD measurements to predict I/M station ASM pass/fail results, when the individual vehicles that are identified by RSD get to the I/M station for their "official" test, they are not as likely to fail as their RSD measurements would seem to indicate. In this situation, an elevated RSD is just another "risk factor" for vehicles that are likely to need repairs rather than a guarantee that the vehicle will fail the ASM. Overall, for individual vehicles, even though RSD is a measurement, its ASM-predicting ability is probabilistic when it comes to forecasting the result of the I/M station emissions test.

9.4 Fleet Coverage by RSD

The size of an RSD data collection effort is driven by the desired coverage of the fleet. RSD cannot get measurements on all vehicles in the on-road fleet. RSD units are deployed preferentially in locations meeting special criteria such as the number of vehicles passing at a time, space on the side of the road to safely fit the equipment, and the speed and operating mode of passing vehicles. Also, it is not generally cost effective to measure at sites with little traffic. Unmanned RSD units will get around some of these limitations, but they have their own limitations having to do with installing utilities in remote areas. Since a certain fraction of the fleet will seldom pass by some RSD sites, that fraction of the fleet has little chance of getting an RSD measurement.

As vehicles pass by an RSD unit, the percentage of observations that will produce data that can be used to select vehicles for I/M program intervention strategies is limited by a number of factors:

- not all of RSD measurements are valid,
- not all produce a license plate image that is usable ,
- not all of vehicles are being operated in a way at the time of the RSD reading that fairly represents the typical emissions of the vehicle,
- Some of the vehicles have already been measured by RSD, and
- Some of the vehicles are not eligible for the I/M program.

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errors, differences between the driving modes of the RSD test and the ASM test, and the difference in response of the vehicle to the RSD test and to the ASM test.

Small RSD programs can rely on sites where the impact of these effects is relatively small. As program sizes increase, sites where the impacts are greater typically must be included in order to obtain the desired fleet coverage. Therefore, the fractions that we use to account for these effects depend upon the size of the program relative to the size of the fleet. For example, in California it takes much more than five times the effort to get a valid reading on 50% of the fleet than on 10% of the fleet.

In this analysis, we discuss the coverage of the fleet with RSD measurements using two different definitions of coverage. Either definition can express RSD coverage relative to either the total number of vehicles in the fleet or the total number of vehicles in the I/M fleet. The important distinction between the two definitions is whether the RSD measurements are taken on a vehicle when it is operating in the emissions-representative VSP range or whether it is operating at any VSP. The two definitions are:

- **Any-VSP RSD coverage** – This refers to the number or fraction of vehicles that receive at least one valid RSD reading (as determined by the RSD analyzer software) on a vehicle that is matched by the license plate to a record in the registration database. The vehicle-specific-power associated with these RSD readings could have any value. The RSD readings could be for vehicles that are operating at moderate load, at steady cruise, under deceleration, or under heavy acceleration. RSD data collection vendors typically use this definition of coverage.

- **Usable-VSP RSD coverage** – This refers to the number of vehicles or fraction of vehicles that receive at least one valid (as determined by the RSD analyzer software) RSD reading on a vehicle that is matched by the license plate to a record in the registration database, and the VSP is in the emissions-representative range. These RSD readings are only those associated with vehicles that are operating at moderate load. For the purposes of selecting vehicles for Directing, Exempting, Calling-In, or Scrapping, or for characterizing the emissions of the fleet, only the RSD readings that have in-range VSPs should be used.

In the implementation report [4], we developed techniques that can be used to estimate the any-VSP coverage and usable-VSP coverage for RSD programs that could supplement the California I/M program. Table 9-7 shows the results of using those techniques to estimate the usable-VSP coverage of the statewide I/M fleet for large, medium, and small RSD programs in California.

Table 9-7. Estimated Counts of Vehicles and RSD Measurements in Large, Medium, and Small California RSD Programs

A	B	C	D	E	F	G	H
		Percent of vehicles in Column D that are subject to I/M (%)	**Percent of vehicles in Column E with at least one in-range VSP (%)**	**Percent of RSDs in Column F representing unique vehicles (%)**			
Any-VSP Coverage (%)	**Statewide Fleet (MY65-MY04) Driving in the 5 Largest AQMDs (number of vehicles)**	**Subject to I/M, In-range-VSP, Unique, Valid, DMV-Matched [c] (number of vehicles)**	**In-range-VSP, Unique, Valid, DMV-Matched (number of vehicles)**	**Unique, Valid, DMV-Matched [b] (number of vehicles)**	**Valid, DMV-Matched [a] (number of RSDs)**	**Statewide I/M Fleet (MY76-MY98) Driving in the Whole State (number of vehicles)**	**Usable-VSP Coverage (%)**
50%		**53.7%**	**79.5%**	**36.5%**			
	18,982,879	4,053,388	7,543,705	9,491,440	25,975,057	13,388,069	30.28%
30%		**51.3%**	**73.9%**	**51.6%**			
	18,982,879	2,157,461	4,206,161	5,694,864	11,026,614	13,388,069	16.11%
10%		**48.9%**	**67.5%**	**73.1%**			
	18,982,879	625,831	1,281,030	1,898,288	2,598,317	13,388,069	4.67%

[a]Used to determine RSD data collection cost.
[b]Used to determine Any-VSP RSD Coverage.
[c]Used to determine Usable-VSP RSD Coverage.

Column A of Table 9-7 shows the desired any-VSP coverage of the three RSD programs with respect to the statewide fleet driving in the five largest AQMDs (Column B). To achieve the desired coverage, valid RSDs must be obtained on the number of vehicles shown in Column E, and the vehicles must be able to be matched with DMV registration records. For example, to achieve 50% any-VSP coverage of the 18,982,879 vehicles driving in the five largest AQMDs, the RSD program must obtain at least one valid RSD on 9,491,440 vehicles that are registered in California. In Column C the table also shows the estimated number of these vehicles that have at least one RSD with an in-range VSP and that are subject to the I/M program. The usable-VSP coverage (Column H) of the statewide IM fleet is the number of vehicles that have at least one RSD with an in-range VSP and that are subject to the I/M program (Column C) divided by the number of vehicles in the statewide I/M fleet (Column G).

From the practical experience of other RSD programs in other states, we know that it is not very practical to get non-VSP-qualified RSD measurements on much more than half of the fleet. Existing RSD programs that wish to maximize fleet coverage have found that once the best RSD sites have been used, the other sites tend to provide a diminishing number of unmeasured vehicles. It takes more and more sites to find fewer and fewer unmeasured vehicles. Therefore, in this pilot study, we chose 50% any-VSP coverage as the largest RSD program to be considered.

Table 9-7 shows that to achieve 50% any-VSP RSD coverage, the state would need to annually pay for 25,975,057 valid measurements (Column F) that could be matched to vehicle registration records. This RSD program would annually provide 7,543,705 RSD measurements (Column D) that could be used to characterize the emissions of the on-road fleet, which includes I/M vehicles and non-I/M vehicles. However, only a portion of the vehicles driving in the five largest AQMDs are biennially inspected I/M vehicles. Additionally, because RSD tends to preferentially measure vehicles that drive more miles, because these vehicles tend to be newer vehicles, and because the newest six model years are exempt from biennial I/M inspection, we expect that a 50% any-VSP RSD coverage program will cover about 53.7% (Column C) of the biennially inspected I/M fleet. Therefore, this RSD program would annually provide 4,053,388 usable RSD measurements (Column C) on I/M vehicles. This is 30% of the 13,388,069 I/M vehicles (Column G) driving in the state. These measurements could be used to select vehicles for special I/M strategies such as Calling-In, Directing, Exempting, and Scrapping. However, since only 30% of the vehicles in the I/M fleet would have usable RSD measurements, 70% of the I/M vehicles in the fleet would not have RSD measurements available to help with vehicle selection.

This large RSD program scenario requires that 50% of the fleet receive a valid, DMV-matched RSD measurement while operating in the emissions-representative VSP range. Although this level of coverage has been achieved in an actual RSD program, for various reasons discussed later, we believe California would find that goal difficult to reach.

The remainder of this section will provide an overview of the methods used to calculate the 2004 fleet characteristics, the percent uniqueness, the percent in-range VSP, and the percent subject to I/M, which are used in Table 9-7. The detailed descriptions of the methods are given in the implementation report [4].

Characteristics of the 2004 California fleet – Table 9-8 shows a breakdown of California's registered vehicles for Calendar Year 2004 by the five largest AQMDs for the statewide fleet and for the I/M fleet.[24] We treated the area outside of the five largest AQMDs as a single area, which we called Rest of State. In Calendar Year 2004, 1976 to 1998 model year vehicles would be subject to the I/M program. The counts of the I/M vehicles driving in the whole state, as estimated by EMFAC, are shown in the fourth column of Table 9-8. We assumed that 10% of vehicles registered outside of the five largest AQMDs annually travel inside of those AQMDs, and that they would be measured by RSD at about the same rate as vehicles that are registered inside the five largest AQMDs. These are vehicles that would happen to get measured by RSD, even though they are not registered in areas where RSD measurements are being taken. This assumption may slightly over-represent these vehicles because they will likely be commuters who travel during rush hours. The counts of the vehicles that are subject to I/M in the five largest AQMDs and the rest of the state and are driving in the five largest AQMDs are shown in the last column of Table 9-8. In this analysis, we modeled the incremental benefits of RSD only for I/M vehicles operated inside the five largest AQMDs, which covers about 83% (=11,358,066/13,388,069) of the statewide I/M fleet.

Potentially, RSD provides emissions measurements of any vehicles that drive past the RSD equipment, but because some vehicles are out-of-area, out-of-state, or out-of-model-year, only a fraction of the vehicles are I/M-program eligible. Table 9-8 also shows that about 59.8% of the 18,982,879 vehicles driving in the five largest AQMDs, or 11,358,066 vehicles, are vehicles that are subject to biennial I/M inspections.

[24] The values are from EMFAC. Details of the EMFAC run are given in Appendix N of Reference 3. The EMFAC version used was EMFAC2007 working draft V2.20.8 Feb 10, 2005.

Table 9-8. Registered Vehicles in California in 2004

Area	Statewide Fleet		Fleet Subject to I/M	
	Model Years 1965-2004		Model Years 1976-1998	
	Driving in the Whole State	Driving in the 5 Largest AQMDs	Driving in the Whole State	Driving in the 5 Largest AQMDs
Sacramento	825,792	825,792	494,098	494,098
San Diego	1,966,649	1,966,649	1,176,709	1,176,709
San Joaquin	2,056,954	2,056,954	1,230,742	1,230,742
South Coast	9,100,769	9,100,769	5,445,282	5,445,282
Bay Area	4,655,741	4,655,741	2,785,679	2,785,679
Rest of State	3,769,745	376,975	2,255,559	225,556
Total	22,375,650	18,982,879	13,388,069	11,358,066

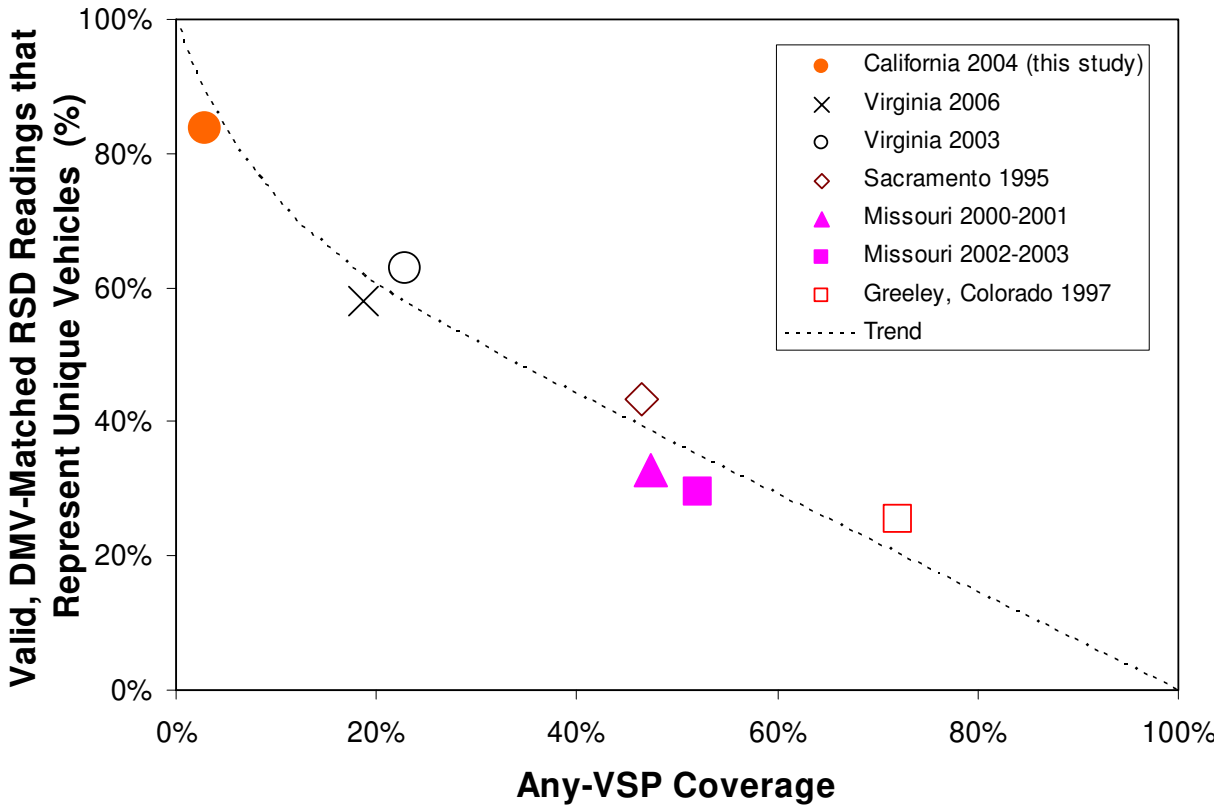
Proj1/Decision Model/Report/IM_Strategy_Evaluator_071119.xls

Percent uniqueness – An RSD program can identify vehicles for special strategies only for those vehicles that receive an RSD measurement. Unfortunately, to obtain at least one valid, DMV-matched RSD measurement on a substantial portion of the vehicles driving in the program area, more RSD measurements than the number of vehicles must be collected. This is because a portion of the RSD readings are actually replicate RSD measurements on the same vehicles obtained as vehicles repeatedly move (e.g., commute) past an RSD measurement site. We define the uniqueness of an RSD program as the ratio of the number of unique vehicles to the number of valid, DMV-matched RSD measurements taken on them. From another perspective, uniqueness is also the reciprocal of the average number of valid, DMV-matched RSD measurements per vehicle.

RSD measurement uniqueness depends on several factors including the quality of the RSD measurement sites, the number of RSD measurement sites in the program area, the length of time that an RSD measurement unit spends at each RSD site, and the any-VSP RSD coverage level that the data collection effort achieves. Figure 9-9 shows how the uniqueness has trended with any-VSP RSD coverage for this pilot study and for several other different RSD data collection efforts.

In Figure 9-9 the point in the upper left corner represents the uniqueness and coverage of the RSD data taken in this pilot study. The other six points are from the other RSD programs or studies and have any-VSP coverages of 20% to 72%, which are substantially higher than the pilot study any-VSP coverage. The 1995 Sacramento and 1997 Greeley efforts were RSD studies. The Virginia and Missouri efforts were ongoing RSD programs.

Figure 9-9. RSD Measurement Uniqueness for Several RSD Efforts



CoverageCalcsForPilotDataset.xls
Virginia 2006: Reference 10, pages 20-21
Virginia 2003: Reference 11, page 21
Sacramento 1995: Reference 12, pages 3-7 and 3-12
Missouri 2000-2001: Reference 13
Missouri 2002-2003: Reference 13
Greeley, Colorado 1997: Reference 14, pages 21 and 64

Two additional theoretical points serve to round out the uniqueness vs. any-VSP coverage trend seen in Figure 9-9. At the limit of 0% coverage, the uniqueness would be 100% since the first few vehicles at each RSD measurement site would receive only one RSD measurement. This point is the upper left corner of Figure 9-9. Similarly, at the limit of 100% coverage, the uniqueness would be 0% since a very large number of RSD measurements would be required to cover all of the vehicles in a fleet. This point is the lower right corner of Figure 9-9. When we consider all of the eleven data points and the two theoretical points together in Figure 9-9, we see a clear and relatively compact trend. We believe that we can use the trend to estimate the uniqueness that would be associated with California RSD programs that are substantially larger than the pilot study.

The locations of the data points in Figure 9-9 are based on uniqueness levels achieved in practice by RSD vendors by the particular design chosen for each particular RSD measurement program. The location of data points depends on the design of the RSD program and the characteristics of the fleet and infrastructure in the area. However, we expect that RSD vendors would chose program designs that tended to be most efficient for a given area and highway infrastructure, and therefore we believe that the trend in the figure represents typical RSD programs.

This methodology is used to calculate the percent uniqueness, which are the percentages in Column E of Table 9-7.

Percent of vehicles with at least one in-range VSP – For an RSD measurement to be usable for vehicle selection, the RSD measurement must be a fair representation of the vehicle's emissions. Accordingly, the VSP associated with the measurement must be in the representative VSP range. When vehicles get more than one RSD measurement, the chance of having at least one in-range VSP increases. This trend is demonstrated by Table 9-9, which shows the distribution of RSD n-hitters[25] in this pilot study.

From the table we can see that across all of the measurements in the pilot study, 85.84% of the vehicles that received at least one valid RSD measurement were 1-hitters. About 61.26% of the 1-hitters had an in-range VSP. The table shows that there were far fewer 2-hitters, but the fraction of vehicles having at least one in-range VSP within that group was higher at 82.41%. The trend continues to higher-hitters. For example, 2.39% of the vehicles that received at least one valid RSD measurement and could be DMV-matched were 3-hitters, that is, they received 3 valid RSD measurements. Of all of the 3-hitters, 90.1% had at least one of the RSD measurements with an in-range VSP.

[25] We define a 1-hitter as a vehicle that has received a single valid RSD measurement, a 2-hitter as a vehicle that has received two valid RSD measurements, etc.

Table 9-9. Observed Counts and In-Range-VSP Occurrence of Multiple-RSD-Hit Vehicles in the California Pilot Study

A	B	C	D	E	F

RSD N-Hitter	Fraction of N-Hitters	Number of N-Hitters	RSD Hits	Fraction of Vehicles with At Least One In-Range VSP	Vehicles with At Least One In-Range VSP
1	0.8584	481483	481483	61.26%	294956
2	0.1074	60217	120434	82.41%	49625
3	0.0239	13407	40221	90.10%	12080
4	0.0067	3769	15076	93.92%	3540
5	0.0022	1219	6095	96.06%	1171
6	0.0008	458	2748	96.94%	444
7	0.0003	164	1148	98.78%	162
Total		560883	667205		361978

Uniqueness	Average Hits/Vehicle	Overall Fraction of Vehicles with At Least One In-Range VSP
0.8406	1.19	64.54%

The overall fraction of vehicles having at least one in-range VSP, which is calculated as the sum of Column F divided by the sum of Column C, is 64.54%. Note that this is slightly higher than the fraction of 1-hitters that had an in-range VSP. To be able to predict the characteristics of standard, full-scale RSD programs in California that are larger than the pilot study, we developed a methodology to calculate the overall fraction of vehicles having at least one in-range VSP. Without an in-range VSP the RSD measurement is useless for selecting vehicles for a special strategy. The methodology calculates the distribution of n-hitters in an RSD program and the fraction of vehicles that have at least one in-range-VSP RSD reading for each of the different n-hitter categories. The only inputs required are the any-VSP coverage and the fraction of 1-hitters that have at least one in-range VSP, which are shown in Table 9-10 for the pilot study. The percent of 1-hitters with an in-range VSP is a characteristic of the RSD sites used to collect the data. Therefore, it does not change with the size of the RSD program, unless moving to a different size RSD program causes the characteristics of the sites to change. The details of the methodology development are given in the implementation report [4].

Table 9-10. In-Range-VSP Percentages for One-Hitters in the Pilot Study

Area	% In-Range VSP for 1-Hitters
Sacramento	43.27%
San Diego	78.96%
San Joaquin	61.64%
South Coast	62.26%
Bay Area	52.08%
California Overall	61.26%

We can use these methods to simulate the distribution of n-hitters and the distribution of in-range VSPs for the pilot study data in Table 9-9. The resulting simulation is in Table 9-11. The simulation is based entirely on two values: the fraction of 1-hitters in the dataset is 0.8406, and the fraction of 1-hitters with an in-range VSP is 61.26%. These values are outlined in bold in Table 9-11. Table 9-11 can be compared with Table 9-9 to determine the accuracy of the simulation.

This methodology is used to calculate the percent in-range VSP, which are the percentages in Column D of Table 9-7.

Table 9-11. Simulated Counts and In-Range-VSP Occurrence of Multiple-RSD-Hit Vehicles in the California Pilot Study

A	B	C	D	E	F

RSD N-Hitter	Fraction of N-Hitters	Number of N-Hitters	RSD Hits	Fraction of Vehicles with At Least One In-Range VSP	Vehicles with At Least One In-Range VSP
1	0.8406	471478	471478	61.26%	288828
2	0.1340	75154	150307	81.53%	61276
3	0.0214	11979	35938	90.63%	10857
4	0.0034	1910	7638	95.07%	1815
5	0.0005	304	1522	97.33%	296
6	0.0001	49	291	98.53%	48
7	0.0000	8	54	99.17%	8
Total		560883	667229		363128

Uniqueness	Average Hits/Vehicle	Overall Fraction of Vehicles with At Least One In-Range VSP
0.8406	1.19	64.74%

Percent of vehicles subject to I/M – According to EMFAC, 59.8% of the vehicles driving in the 5 largest AQMDs are subject to biennial I/M inspections. This fraction is based upon registration data and does not take into account the fact that some vehicle groups are driven more than others. Because RSD data collection tends to see frequently driven vehicles more often, and because younger vehicles, most of which are not subject to I/M, are driven more than older vehicles, the percent of RSDed vehicles that are I/M vehicles would approach 59.8% only as the any-VSP coverage of the fleet approached 100%. The reason for this is that at 100% coverage, every vehicle in the fleet would have at least one RSD. Thus, the tendency of RSD to observe vehicles with high VMT goes away at high coverages. At lower RSD coverages, the fraction of the RSDed vehicles that are I/M vehicles would be lower than 59.8% because vehicles with low VMT would tend to not be seen by RSD. We know that 48.0% of the RSDed vehicles in the 3.0% any-VSP coverage pilot study were I/M vehicles. Due to the lack of data between these points, we assume that the relationship between the any-VSP coverage and the percent of RSDed vehicles that are I/M vehicles is linear. Since, in any case, the range of values of percent of vehicles subject to I/M is narrow, the error introduced by this assumption is minimal.

This methodology is used to calculate the percent subject to I/M, which are the percentages in Column C of Table 9-7.

California-specific issues affecting a high-coverage RSD program – As we have seen at the beginning of this section, actual RSD programs would need to have high coverage – perhaps on the order of 50% any-VSP coverage – to begin to be effective at targeting a substantial portion of the IM fleet for special strategies. In the previous subsections, we used the pilot study data and other RSD programs to estimate the effects of a high coverage program on percent uniqueness, percent in-range VSP, and percent subject to I/M. The calculations that estimate the mass emissions benefits and costs of a 50% coverage program assume that California has a sufficient supply of RSD sites of the same quality as those used in the pilot study. However, we believe that certain special characteristics of the California situation, which are difficult to quantify with the existing data for a large RSD program, can have important influences on the ability of a California RSD program to achieve high coverages as easily as those achieved in other jurisdictions up to the current time. Specifically, we believe that achieving high RSD coverages in California will be more difficult and therefore more expensive than in most other jurisdictions. This is primarily a result of the frequent use of metered, multiple-lane freeway on-ramps used throughout California in locations where traffic volume is high.

The pilot study achieved about 3% coverage in California's largest five AQMDs taken together. This was done using mainly freeway on-ramps in the Bay area and Sacramento, but in other areas RSD sites were mainly at surface streets because the applicable agency would not always issue permits for RSD testing on freeway ramps. We expect that in a regular RSD program the permit problems could be resolved.

The question is, "What would happen in a real RSD program in California that is operating at 50% coverage?" A 50% coverage program would be 16 times larger then the pilot program. With such a large increase in size, there is no guarantee that a sufficient number of good RSD sites would be available to provide 50% coverage of the fleet. With respect to a high coverage RSD program, California is different from previous RSD programs in other jurisdictions. Many high volume freeway on-ramps in California are metered and have multiple lanes. In addition, the California situation is different because it is a large area in a large state and the area is made up of multiple large metropolitan areas. Previous RSD programs in Missouri, Georgia, Virginia, and Colorado covered single large metropolitan areas.

To help determine if the 50% coverage program could be done in California, Sierra Research, a member of the pilot project team, conducted an extensive field study of the Sacramento metropolitan area to determine if there were limitations to achieving 50% coverage. Sacramento was used as a surrogate for the California fleet and infrastructure.

That coverage evaluation study found that because of a shortage of suitable freeway ramps that simultaneously have high volume, a large fraction of vehicles driving in an acceptable VSP range, adequate separation between vehicles, and the physical space for RSD equipment, only 19% of the fleet can be observed using the suitable freeway ramps. Their analysis indicates that 49% coverage could eventually be achieved by adding RSD measurements at unsuitable ramps over a long period of time:

> "Based on a detailed survey conducted in the Sacramento, California metropolitan area, only about 19% of passenger cars and light-duty trucks registered in the area use freeway ramps that have operating conditions suitable for the measurement of exhaust emissions by remote sensing devices most of the time. Most vehicles use ramps that are either physically unsuitable for remote sensing (e.g., multiple lanes) or that usually have operating conditions (e.g., high congestion levels) that are unsuitable for remote sensing due to inadequate separation between passing vehicles or vehicle operating conditions that are poorly correlated with average emissions in stop-and-go driving.
>
> An estimated 49% of the fleet can eventually be measured on freeway ramps under suitable operating conditions if monitoring is done for an extended period

of time (i.e., many weeks) at all ramps that are physically suitable. This estimate is based on the fact that there is a finite, non-zero probability of measuring a vehicle under suitable operating conditions even at ramps that routinely have unsuitable vehicle operating conditions. The other half of the fleet either does not frequently use the freeway system or uses ramps that are physically incompatible with the use of remote sensing.

Given the practical problems associated with making emissions measurements on surface streets, the potential for measuring vehicle emissions with remote sensing devices is more limited than has been previously realized. The most significant factor affecting our conclusions is that the study area, like most other metropolitan areas in California, has more extensive use of multilane on-ramps with ramp metering. Such ramps are not suitable for remote sensing for two reasons. First, two separate lanes of traffic make it impractical to identify individual vehicle exhaust plumes. Second, ramp meters routinely produce vehicle operating conditions (deceleration and queues approaching the meter and hard acceleration after the meter) that are outside the range of operation that correlates with average emissions in stop-and-go driving.

Merging of the instrumented vehicle survey results with trip information derived from a regional traffic model showed that a typical deployment of remote sensing equipment, rotated between the sites identified as suitable, would result in approximately 19% of the light-duty vehicle fleet receiving a representative measurement by a remote sensing device in a relatively short period of time. Because ramps considered unsuitable would occasionally produce representative vehicle operating conditions, representative measurements could be obtained for a higher fraction of the fleet if remote sensing equipment were deployed at additional ramps. The longer the deployment, the greater the number of vehicles that could eventually be measured under representative conditions. However, because many of the ramps were physically unsuitable (regardless of congestion levels), and because a significant fraction of the fleet does not routinely use the freeway system, the upper limit for fleet coverage on freeway ramps is only about 49%.

The inability of remote sensing devices to collect representative emissions measurements for the majority of the vehicle fleet limits the extent to which remote sensing can be used to either replace or augment a conventional vehicle I/M program. This limitation does not affect the ability to use remote sensing for emissions inventory or I/M program evaluation purposes, as long as any sample bias resulting from the feasible measurement sites is addressed.

Surface streets are generally impractical for remote sensing because there are few roadways with a single lane of travel in each direction and a median strip where remote sensing equipment can be located. In addition, such roadways typically handle a relatively low volume of traffic. Based on the detailed review of hundreds of road routes extracted from transportation models for metropolitan

> areas, a very small fraction of the vehicle population routinely uses roadways with median strips and a single lane of traffic traveling in each direction. The ability of RSDs to make usable emissions measurements on a high fraction of the vehicle fleet therefore depends on the extent to which motorists routinely use freeway ramps and the few surface streets meeting the above descriptions under traffic conditions that allow for measurements to be made."

Sierra did not evaluate the possibility of using surface streets for supplemental RSD data collection. However, we know that surface streets can be used because we used surface streets in the pilot study – although the pilot study was performed at only 3% coverage, not at 50% coverage. In addition, in the pilot study we used four lane surface streets with a center median and blocked off one lane on one side to provide a single lane RSD site. This approach is adequate for a pilot study but such a configuration could cause a restriction of traffic on a high volume street. Therefore, we do not believe that this approach would be viable for a large regular RSD program.

In any case, if suitable freeway RSD sites are as limited in the rest of California as the Sierra report indicates that they are in Sacramento, special methods would be needed to achieve high RSD coverage levels. These special methods would include measuring at less suitable freeway ramps and at surface street sites. Both types of sites will tend to produce lower daily rates of unique I/M vehicles with valid, in-range-VSP RSD measurements. The use of such special methods to try to achieve high coverage will tend to put pressure towards a higher cost for valid RSD readings. This pressure in turn would tend to increase the price per valid, DMV matched RSD reading that California would be asked to pay.

We did not attempt to quantify how much these California-specific issues would increase the price of each valid, DMV-matched RSD reading. Therefore, the calculations in the remainder of this report are made assuming that these California-specific issues have no effect on cost and cost-effectiveness. Consequently, we expect that the true costs of an RSD program would be greater than the values reported in this document.

9.5 RSD for Identifying Individual Vehicles for Special Strategies

The results of this study indicated that using RSD to supplement special strategies for the existing California I/M program would not be cost-effective. First, we believe that the inherent time-varying emissions of individual vehicles and other sources of variability cause a relatively poor correlation between the RSD measurements obtained on the road and the ASM validation test that would be performed at an I/M station before a vehicle would be allowed to participate in a special strategy. Second, even in the largest practical RSD program, coverage of the vehicles

in the I/M fleet with usable RSD measurements would not exceed 30%. The loss in benefits because of poor correlation between the RSD measurements and the I/M station test and from the low I/M fleet coverage results in an application of RSD measurements that would not be cost-effective.

In Section 9.2 we demonstrated using duplicate RSD data and duplicate ASM data that vehicle emissions are inherently time-varying. This vehicle emissions variability produces poor correlations between RSD readings on the same vehicle on consecutive days, poor correlations between ASM readings on the same vehicle in separate tests, poor correlations between RSD and roadside ASMs that immediately follow the RSD, and it helps to produce the poor correlation between RSD measurements and I/M station ASM tests performed weeks later. Although we have not performed a formal analysis of variance to quantify the size of the different contributions toward the variability of emissions measurements it seems apparent that the inherent variability of vehicle emissions is a large contributor.

It is a common and perhaps reasonable notion that whenever a vehicle is identified by an RSD measurement as a candidate for a special strategy, the emissions of the vehicle should be validated by an ASM test at an I/M station. While validation seems to be a requirement of selection by RSD, doing it opens up the vehicle emissions variability "can of worms." Besides emissions variability, there are several other reasons that a validation ASM test would not be able to validate the RSD reading. These include Sources of Variability 2 through 9 in Section 9.1.

It would seem that requiring multiple RSDs for selection of a vehicle and multiple ASMs for validation could help reduce the variability. However, if that were done, the cost of the program would increase, the number of vehicles that could participate in special strategies would decrease, and Sources of Variability 6, 7, 8, and 9 would still remain. Even if the validation test were changed to be validation by RSD, the fraction of validated failures would probably still not be near the desired value of 100% because of Sources of Variability 1, 2, 3, 7, and 9.

Even in the largest practical RSD program that we can conceive of (50% any-VSP RSD coverage in the five largest AQMDs), only about 30% of the vehicles in the statewide I/M fleet would receive at least one usable RSD measurement. This means that only 30% of the statewide vehicles would even be available for selection using RSD measurements. Furthermore, the cost of that large RSD data collection program would be high. Our analysis indicates that medium and small RSD programs would have disproportionately lower costs and would, therefore, be

more cost-effective than the large program. Nevertheless, even the smaller programs would still not be cost-effective and would cover even smaller portions of the I/M fleet.

9.6 RSD for Fleet Emissions Characterization and I/M Program Evaluation

One of the valuable uses of RSD information is to "characterize fleet emissions." When we characterize fleet emissions, we are not interested in the emissions of any individual vehicles. We are not trying to identify ASM passes or failers. We are not trying to predict I/M station ASM test results for individual vehicles. Instead, we are interested in the emissions characteristics of different types of large subsets of the fleet. For example, we might want to know average emissions for different model years, different I/M program calendar years, different AQMDs, test-only station clients vs. test-and-repair station clients, 90 days before I/M inspection vs. 90 days after I/M inspection, different vehicle operating modes, in-state plates vs. out-of-state plates, or I/M program participants vs. I/M program non-participants.

The need is to measure emissions and not to predict an I/M ASM result – To select individual vehicles for a special strategy, RSD must forecast the result of an I/M station ASM emission test. As discussed in the previous subsections, that is a challenging job for any emissions test. Even though RSD is a measurement, because of the many sources of variability, forecasting ASM pass/fails from RSD is highly probabilistic in nature. On the other hand, to characterize fleet emissions we do not need to examine the emissions of individual vehicles or to forecast what their I/M station ASM results will be. RSD just needs to provide an unbiased measurement of tailpipe emissions. RSD can even be noisy – as long as it is unbiased. Averaging many individual vehicle observations can reduce noise, but it cannot reduce bias.

RSD measures actual tailpipe emissions concentrations – Dry gas audit tests show that RSD is able to measure known gas concentrations with relatively good accuracy and low uncertainty (although not quite as low as ASM audits). From this we conclude that RSD measurements on vehicles are a relatively good measure of the tailpipe emissions of the vehicle at the exact time of the measurement.

Sub-fleet averages of RSD values have low variability and (probably) low bias – While the RSD values are good measurements of instantaneous emissions concentrations, the emissions of an individual vehicle vary widely with time. Part of the time the instantaneous emissions are above and at other times the instantaneous emissions are below the characteristic, long-term average emissions of the vehicle. The individual RSD measurements of many individual vehicles can be averaged to reduce the variability produced by different sources of variability. If RSD measures a representative sample of the fleet under a representative set of

vehicle operating conditions, the average of the emissions values will be representative of the fleet as a whole. We can apply the same approach to different sub-fleets to arrive at emissions characteristics for them.

All of this depends on RSD being unbiased, which means that the RSD values match the actual emissions concentration of the vehicle. It may be that under certain vehicle operating modes, for example, during decelerations with closed throttle when the tailpipe plume is small, RSD may have problems obtaining a reliable emissions measurement.

The value of averaging RSD measurements for the purpose of characterizing the fleet can be also demonstrated using the 416 pairs of RSD and ASM measurements that were collected in this study. These measurements were used in Section 9.3 to demonstrate the highly scattered connection between RSD values and ASM values for individual vehicles. However, in this case, the large amount of scatter is not a great concern because when a large number of individual readings of RSD concentrations are averaged the uncertainty in the average value can be much smaller than the uncertainty in the individual values for an individual vehicle.

Figures 9-12, 9-12, and 9-14 show scatter plots for the 416 pairs of observations for RSD versus Roadside ASM2525 HC, CO, and NO measured immediately after the RSDs. For each of the three plots, there are a handful of points that are off the plots, which we have made to focus on the vicinity near the origin. Each of these three plots again demonstrates the poor correlation between the RSD and ASM measured values for individual vehicles. The r^2 statistics for the three plots would be quite low. The plots do not show any clear evidence of a linear relationship between RSD and ASM values.

However, if we average the RSD values and the ASM values by model year and plot the model year averages for RSD against those for ASM2525, we arrive at the plots in Figures 9-11, 9-13, and 9-15. In these figures, the areas of the bubbles are proportional to the number of data points that were averaged for each model year. The number of observations for each model year ranges from 1 to 35. Examination of these three model year average plots shows the beginning of the appearance of a proportional relationship between the RSD and ASM2525 model year average values. This means that a group of vehicles that has a high average RSD value will have a high average ASM2525 value. Groups of vehicles that are observed on the road with a low average RSD value will have a low average roadside ASM2525 value on the road.

The averages shown in Figures 9-11, 9-13, and 9-15 were based on the small dataset with 416 observations. Collection of this dataset, which is made up of RSD measurements followed immediately by roadside ASM measurements on a randomly selected set of vehicles, is rather

unusual because of the effort required to collect the roadside/RSD paired data. If additional data had been collected, we would expect that the plots of model year averages would become less and less scattered as more data points were added to the dataset. In spite of the relatively small size of the dataset that was collected, the Figures 9-10, 9-12, and 9-14 clearly show that RSD measurements on individual vehicles are highly scattered with ASM measurements. However, when averages are taken, the average RSD measurement of a group of vehicles is proportional to the average ASM measurement of the same group of vehicles.

Figure 9-10. Comparison of Individual Vehicle RSD and Immediate Roadside ASM2525 for HC

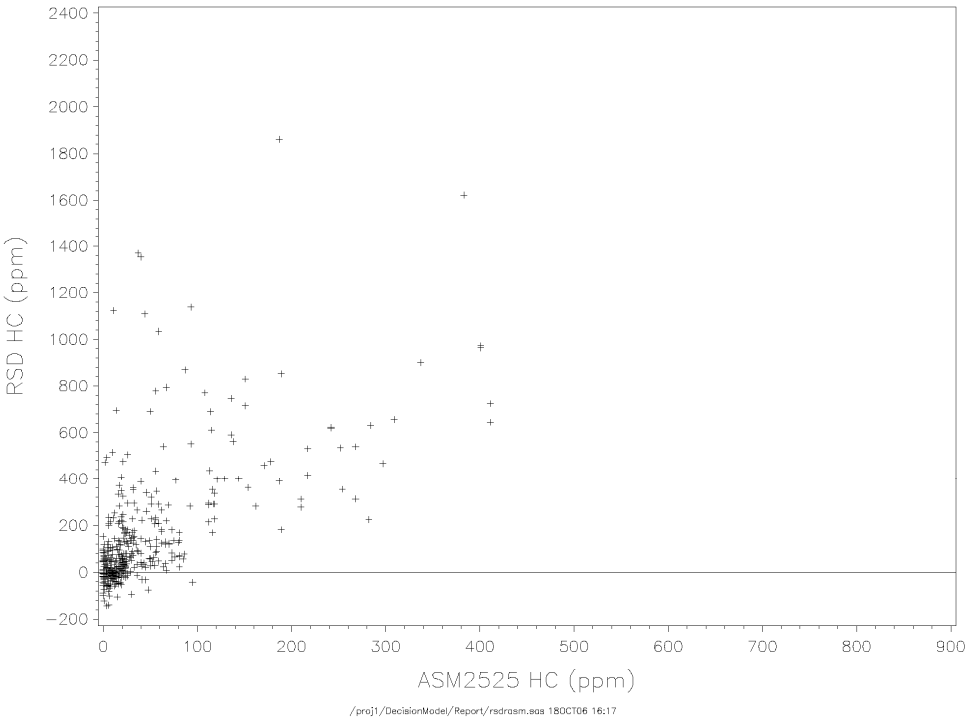


Figure 9-11. Comparison of Model Year Average RSD and Immediate Roadside ASM2525 for HC

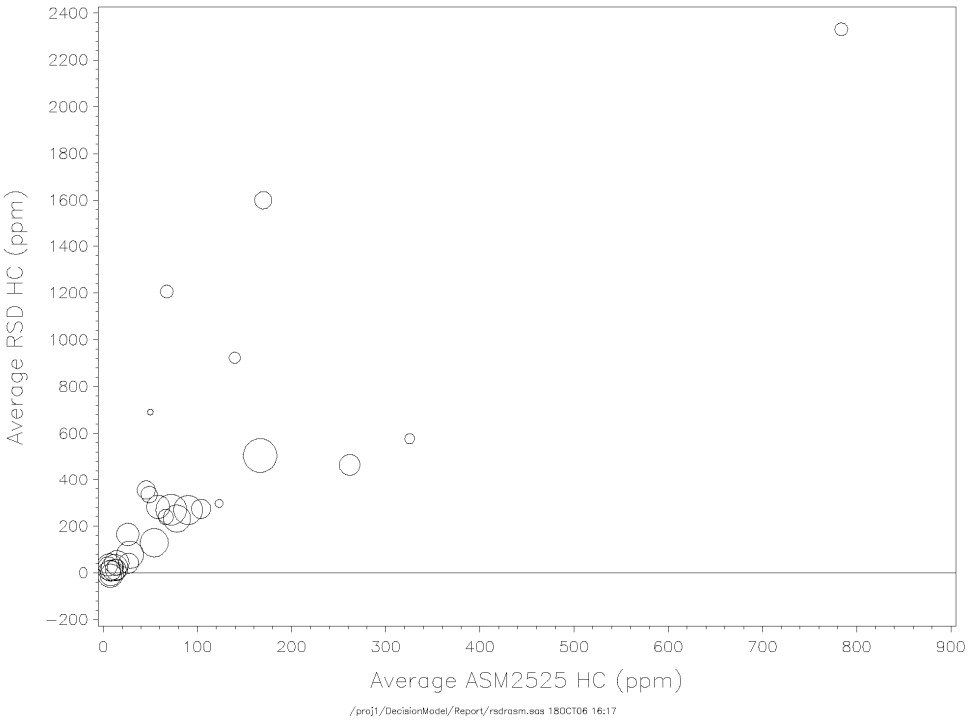


Figure 9-12. Comparison of Individual Vehicle RSD and Immediate Roadside ASM2525 for CO

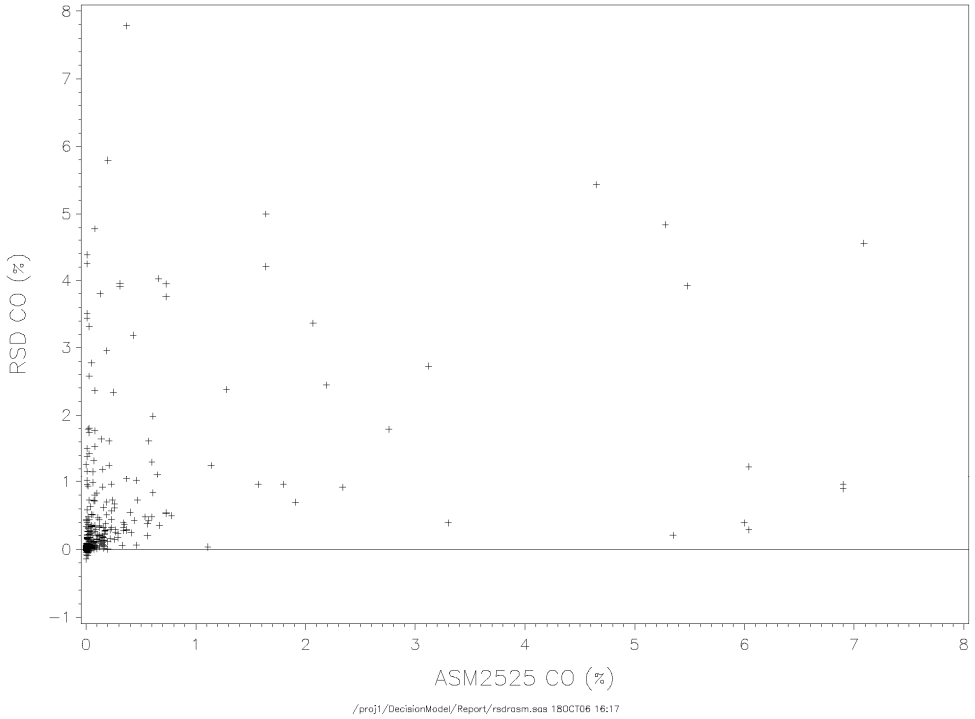


Figure 9-13. Comparison of Model Year Average RSD and Immediate Roadside ASM2525 for CO

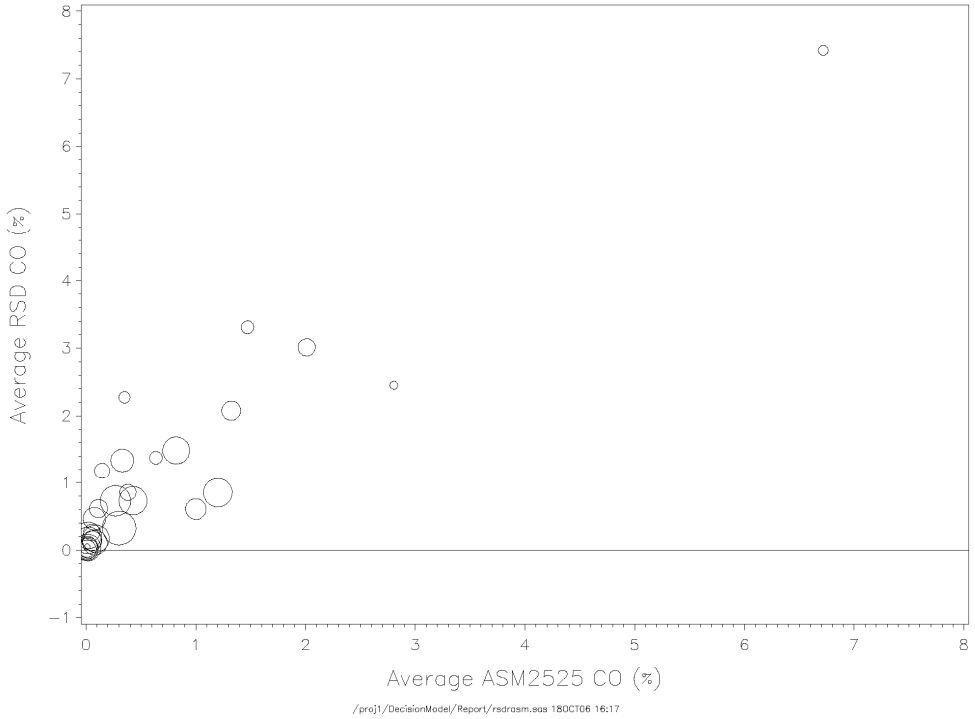


Figure 9-14. Comparison of Individual Vehicle RSD and Immediate Roadside ASM2525 for NO

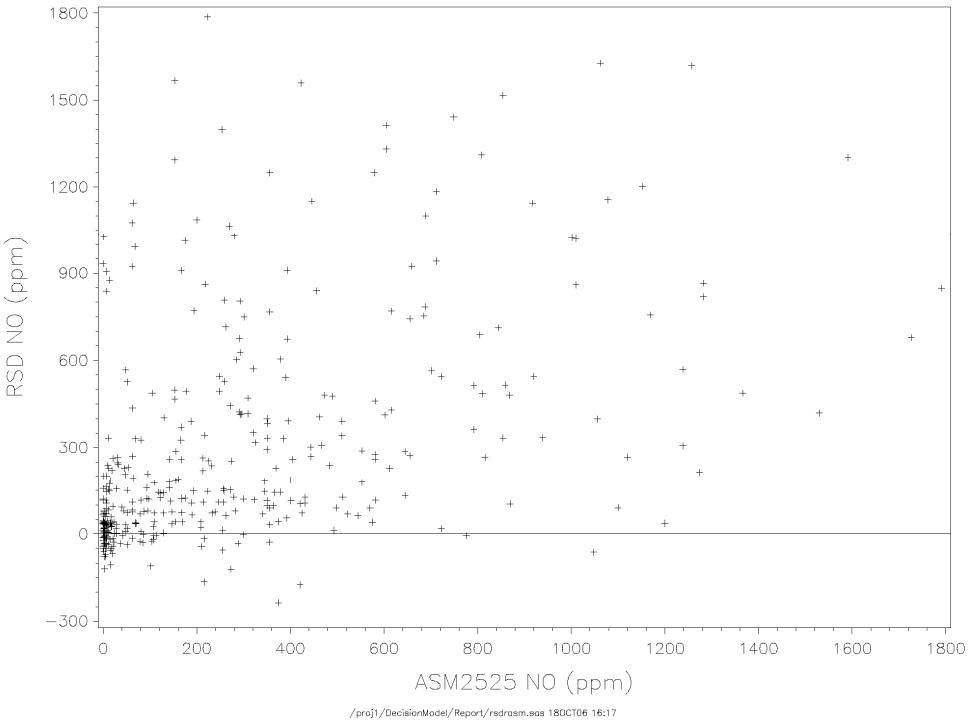
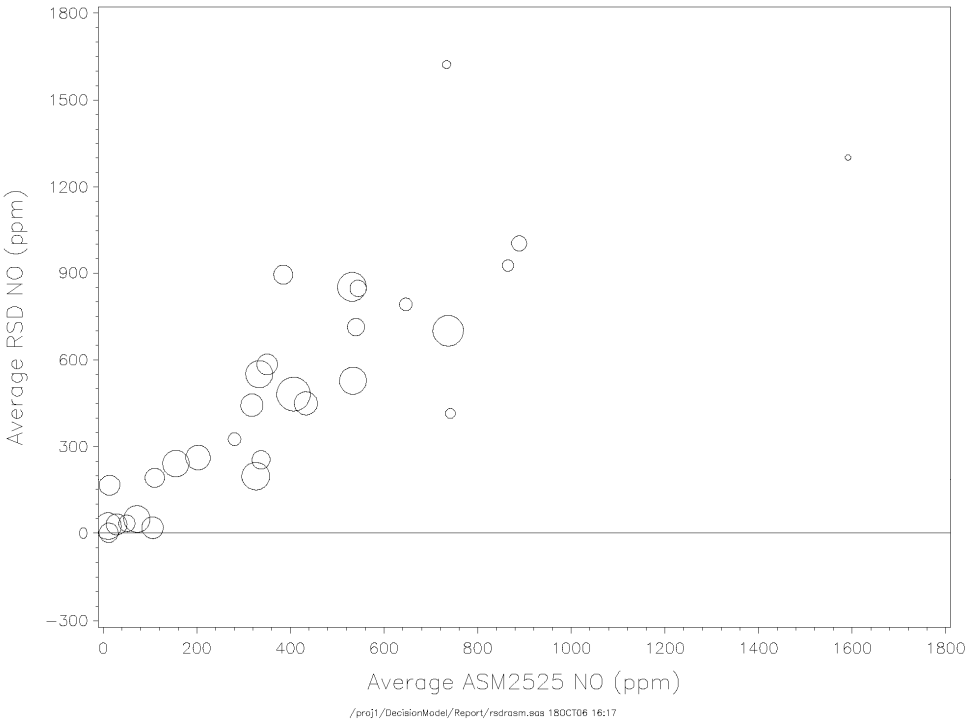


Figure 9-15. Comparison of Model Year Average RSD and Immediate Roadside ASM2525 for NO



RSD measurements are independent of the I/M program – One of the big strengths of RSD is that it can be used to evaluate an I/M program because the RSD measurements are independent of the measurements reported by the I/M program in the VID. Emission results in the VID are affected by the measurement inaccuracies of the I/M stations and instruments. Pre-inspection repairs by vehicle owners also prevent the I/M measurements from representing the characteristic emissions of the vehicle. I/M inspections also measure emissions at only one time per I/M cycle – when the vehicle comes in for inspection – but vehicles emit and degrade throughout the I/M cycle. Because the timing of RSD measurements is random with respect to I/M inspections, RSD is better able to measure the overall effect of I/M. Finally, unlike VID data, RSD measures non-I/M vehicles as well as I/M vehicles. This allows comparisons to be made between different segments of the on-road fleet that are impossible to make with VID data alone.

Vehicle selection using VID history is a better first choice than using RSD – The historical VID data from California's I/M program can be used to build effective and cost-effective vehicle selection strategies. The reason these strategies can be built is because the program performs tailpipe emissions tests on all I/M-eligible model year vehicles[26] – even on OBD vehicles. These VID-history-based strategies are as good as RSD-based strategies at reducing the mass of emissions, cover virtually the entire I/M fleet, and are far less costly to implement than an RSD program. Therefore, in this competitive situation, it makes sense to choose the VID-history method over the RSD program for special strategies as the first level of improvement to the existing I/M program.

Then, the question becomes, "Does it make sense to add RSD as a second level improvement?" If RSD was not cost-effective when competing directly against the VID-history-based strategies, then it only makes sense that after the VID-history-based strategies have identified the most obvious vehicles, RSD will be even less cost-effective than before. RSD measurements, or any emissions test, will have a difficult time in further reducing the tons of emissions. The high cost of an RSD program makes getting those few "incremental" tons not cost-effective.[27]

[26] Jurisdictions that do not perform emissions inspections on 1996 and newer vehicles do not have VID data that can be used to build these models.

[27] Keep in mind that this study's conclusion of RSD cost-ineffectiveness applies only to using RSD as an incremental component to an existing I/M program that conducts an emissions inspection on all vehicles of all eligible model years. We have not studied the effectiveness and cost-effectiveness of an RSD program in jurisdictions that do not have an I/M program.

10.0 Conclusions

This study finds that in the California situation where an I/M program already exists:

- Supplementing the I/M program with an RSD measurement component can effectively reduce mass emissions through special strategies by selecting individual vehicles. However, even the largest practical RSD program would be able to obtain usable RSD measurements only on about 30% of the statewide I/M fleet. Whether the RSD program is large or small, the high cost of RSD relative to the mass of emissions reduced makes RSD not cost-effective for selecting individual vehicles for participation in special strategies.

- Supplementing the I/M program with a VID-History-based High Emitter Profiler can reduce mass emissions just as effectively as RSD. In contrast to RSD, the VID History method can cover essentially 100% of the fleet and, because the source of information is the VID rather than an on-going field data collection effort, the VID History method can be cost-effective.

- Adding an RSD measurement component to an I/M program that has already been improved with VID-History-based special strategies can make only minor further reductions in mass emissions. The high cost of RSD relative to the mass of emissions reduced makes adding an RSD component in this scenario quite cost-ineffective.

- Nevertheless, because of RSD's ability to measure the on-road emissions of groups of vehicles without bias and to measure them independently of the I/M program, we believe RSD can be an effective tool for characterizing the fleet and evaluating the I/M program. (We did not attempt to estimate its cost-effectiveness for this activity).

11.0 References

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Appendix A
Effects of Varying Fleet Targeting Percentage

Table A-1. Calling-In at 2% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 2% Targeting (N)		267,761	81,068	267,761	
Targeted Vehicles that Fail ASM at Decision Point (N)		92,176	39,758	99,984	7,808 more vehicles to fail
ASM Fail Rate at Decision Point (%)		34.4%	49.0%	37.3%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **542,980,156** failed miles driven	A decrease of **52,389,946** failed miles driven	A decrease of **576,997,132** failed miles driven	A further decrease of **34,016,976** failed miles driven
	Total ΔFTP HC+NOx (tons/2years) [f]	A decrease of **2,312** tons	A decrease of **436** tons	A decrease of **2,485** tons	A further decrease of **173** tons
Total Costs ($/2years)		**$ 32,132,224** spent	**$ 66,228,159** spent	**$ 85,436,518** spent	A further increase of **$ 53,304,297** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 13,899** spent for each ton of emissions reduced	**$151,887** spent for each ton of emissions reduced	**$ 34,383** spent for each ton of emissions reduced	An additional **$ 308,174** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-2. Calling-In at 5% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 5% Targeting (N)		669,403	202,669	669,403	
Targeted Vehicles that Fail ASM at Decision Point (N)		222,039	88,237	235,806	13,767 more vehicles to fail
ASM Fail Rate at Decision Point (%)		33.2%	43.5%	35.2%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **972,447,180** failed miles driven	A decrease of **129,859,872** failed miles driven	A decrease of **1,012,914,979** failed miles driven	A further decrease of **40,467,799** failed miles driven
	Total ΔFTP HC+NOx (tons/2years) [f]	A decrease of **4,595** tons	A decrease of **994** tons	A decrease of **4,825** tons	A further decrease of **230** tons
Total Costs ($/2years)		**$ 72,915,946** spent	**$ 79,820,101** spent	**$ 127,029,468** spent	A further increase of **$ 54,113,525** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 15,870** spent for each ton of emissions reduced	**$ 80,283** spent for each ton of emissions reduced	**$ 26,329** spent for each ton of emissions reduced	An additional **$ 235,067** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-3. Calling-In at 7% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 7% Targeting (N)		937,165	283,737	937,165	
Targeted Vehicles that Fail ASM at Decision Point (N)		294,208	115,334	312,023	17,814 more vehicles to fail
ASM Fail Rate at Decision Point (%)		31.4%	40.6%	33.3%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **1,156,345,280** failed miles driven	A decrease of **176,783,110** failed miles driven	A decrease of **1,195,379,522** failed miles driven	A further decrease of **39,034,242** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **5,673** tons	A decrease of **1,309** tons	A decrease of **5,921** tons	A further decrease of **249** tons
Total Costs ($/2years)		**$ 98,148,876** spent	**$ 88,172,222** spent	**$ 152,812,023** spent	A further increase of **$ 54,663,150** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 17,302** spent for each ton of emissions reduced	**$ 67,376** spent for each ton of emissions reduced	**$ 25,807** spent for each ton of emissions reduced	An additional **$ 219,958** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-4. Calling-In at 10% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 10% Targeting (N)		1,338,807	405,339	1,338,807	
Targeted Vehicles that Fail ASM at Decision Point (N)		387,754	150,603	412,217	24,462 more vehicles to fail
ASM Fail Rate at Decision Point (%)		29.0%	37.2%	30.8%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **1,337,903,777** failed miles driven	A decrease of **242,364,655** failed miles driven	A decrease of **1,381,411,028** failed miles driven	A further decrease of **43,507,251** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **6,824** tons	A decrease of **1,730** tons	A decrease of **7,151** tons	A further decrease of **328** tons
Total Costs ($/2years)		**$ 134,000,880** spent	**$ 99,970,192** spent	**$ 189,566,837** spent	A further increase of **$ 55,565,960** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 19,638** spent for each ton of emissions reduced	**$ 57,802** spent for each ton of emissions reduced	**$ 26,508** spent for each ton of emissions reduced	An additional **$ 169,508** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-5. Directing at 20% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 20% Targeting (N)		2,677,614	810,678	2,677,614	
Δ^{i} Targeted Vehicles that Fail ASM at Decision Point (N)		72,309	24,466	78,319	6,010 more vehicles to fail
Δ^{i} ASM Fail Rate at Decision Point (%)		2.7%	3.6%	2.8%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **418,433,374** failed miles driven	A decrease of **111,237,251** failed miles driven	A decrease of **443,945,462** failed miles driven	A further decrease of **25,512,088** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **2,703** tons	A decrease of **841** tons	A decrease of **2,881** tons	A further decrease of **178** tons
Total Costs ($/2years)		**$ 17,488,178** spent	**$ 61,151,058** spent	**$ 70,858,125** spent	A further increase of **$ 53,409,949** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 6,470** spent for each ton of emissions reduced	**$ 72,741** spent for each ton of emissions reduced	**$ 24,611** spent for each ton of emissions reduced	An additional **$ 300,392** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table A-6. Directing at 30% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 30% Targeting (N)		4,016,421	1,216,017	4,016,421	
Δ^{i} Targeted Vehicles that Fail ASM at Decision Point (N)		96,260	36,403	102,430	6,170 more vehicles to fail
Δ^{i} ASM Fail Rate at Decision Point (%)		2.4%	3.0%	2.6%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **518,814,235** failed miles driven	A decrease of **146,068,806** failed miles driven	A decrease of **543,556,357** failed miles driven	A further decrease of **24,742,122** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **3,591** tons	A decrease of **1,095** tons	A decrease of **3,761** tons	A further decrease of **170** tons
Total Costs ($/2years)		**$ 22,134,667** spent	**$ 62,496,823** spent	**$ 75,575,606** spent	A further increase of **$ 53,440,942** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 6,164** spent for each ton of emissions reduced	**$ 57,067** spent for each ton of emissions reduced	**$ 20,095** spent for each ton of emissions reduced	An additional **$ 314,893** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table A-7. Directing at 40% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 40% Targeting (N)		5,355,228	1,621,355	5,355,228	
Δ^{i} Targeted Vehicles that Fail ASM at Decision Point (N)		115,080	41,232	120,727	5,647 more vehicles to fail
Δ^{i} ASM Fail Rate at Decision Point (%)		2.1%	2.5%	2.3%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **594,758,300** failed miles driven	A decrease of **172,236,354** failed miles driven	A decrease of **616,084,457** failed miles driven	A further decrease of **21,326,157** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **4,339** tons	A decrease of **1,303** tons	A decrease of **4,489** tons	A further decrease of **150** tons
Total Costs ($/2years)		**$ 25,785,903** spent	**$ 63,433,712** spent	**$ 79,125,359** spent	A further increase of **$ 53,339,459** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,943** spent for each ton of emissions reduced	**$ 48,680** spent for each ton of emissions reduced	**$ 17,628** spent for each ton of emissions reduced	An additional **$ 356,496** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table A-8. Directing at 50% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 50% Targeting (N)		6,694,035	2,026,694	6,694,035	
Δ^i Targeted Vehicles that Fail ASM at Decision Point (N)		131,230	44,660	135,515	4,286 more vehicles to fail
Δ^i ASM Fail Rate at Decision Point (%)		2.0%	2.2%	2.0%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **655,005,214** failed miles driven	A decrease of **191,441,418** failed miles driven	A decrease of **671,113,632** failed miles driven	A further decrease of **16,108,418** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **5,007** tons	A decrease of **1,479** tons	A decrease of **5,121** tons	A further decrease of **114** tons
Total Costs ($/2years)		**$ 28,918,826** spent	**$ 64,098,685** spent	**$ 81,994,229** spent	A further increase of **$ 53,075,406** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,776** spent for each ton of emissions reduced	**$ 43,337** spent for each ton of emissions reduced	**$ 16,011** spent for each ton of emissions reduced	An additional **$ 463,909** spent for each additional ton of emissions reduced

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table A-9. Exempting at 5% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 5% Targeting (N)		669,403	202,669	669,403	
Targeted Vehicles that Fail ASM at Decision Point (N)		26,877	1,332	23,073	3,803 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		4.0%	0.7%	3.4%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **72,521,124** failed miles driven	An increase of **9,824,345** failed miles driven	An increase of **46,703,650** failed miles driven	The reduction of an additional **25,817,474** failed miles driven are preserved
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	An increase of **433** tons	An increase of **217** tons	An increase of **282** tons	An additional **151** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 14,944,866**	**$ 49,268,209** spent	**$ 36,967,056** spent	A further increase of **$ 51,911,925** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 34,542** for each ton of emissions increased	**$ 227,442** spent for each ton of emissions increased	**$ 131,224** spent for each ton of emissions increased	An additional **$ 343,915** spent for each additional ton of emission reductions not lost through exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-10. Exempting at 10% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 10% Targeting (N)		1,338,807	405,339	1,338,807	
Targeted Vehicles that Fail ASM at Decision Point (N)		37,467	2,936	32,180	5,287 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		2.8%	0.7%	2.4%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **92,618,632** failed miles driven	An increase of **20,893,935** failed miles driven	An increase of **62,332,686** failed miles driven	The reduction of an additional **30,285,946** failed miles driven are preserved
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	An increase of **788** tons	An increase of **447** tons	An increase of **632** tons	An additional **156** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 34,771,829**	**$ 43,125,509** spent	**$ 17,010,553** spent	A further increase of **$ 51,782,385** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 44,134** for each ton of emissions increased	**$ 96,423** spent for each ton of emissions increased	**$ 26,929** spent for each ton of emissions increased	An additional **$ 331,564** spent for each additional ton of emission reductions not lost through exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-11. Exempting at 20% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 20% Targeting (N)		2,677,614	810,678	2,677,614	
Targeted Vehicles that Fail ASM at Decision Point (N)		58,371	7,071	50,794	7,577 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		2.2%	0.9%	1.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **143,777,037** failed miles driven	An increase of **48,037,384** failed miles driven	An increase of **106,007,297** failed miles driven	The reduction of an additional **37,769,740** failed miles driven are preserved
	Total ΔFTP HC+NOx (tons/2years) [f]	An increase of **2,358** tons	An increase of **944** tons	An increase of **2,098** tons	An additional **260** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 74,449,922**	**$ 30,921,021** spent	A savings of **$ 22,867,465**	A further increase of **$ 51,582,461** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 31,573** for each ton of emissions increased	**$ 32,772** spent for each ton of emissions increased	A savings of **$ 10,901** for each ton of emissions increased	An additional **$ 198,230** spent for each additional ton of emission reductions not lost through exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-12. Exempting at 30% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 30% Targeting (N)		4,016,421	1,216,017	4,016,421	
Targeted Vehicles that Fail ASM at Decision Point (N)		87,352	12,938	76,689	10,664 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		2.2%	1.1%	1.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **224,627,821** failed miles driven	An increase of **84,244,644** failed miles driven	An increase of **177,873,161** failed miles driven	The reduction of an additional **46,754,660** failed miles driven are preserved
	Total ΔFTP HC+NOx (tons/2years) [f]	An increase of **4,087** tons	An increase of **1,499** tons	An increase of **3,768** tons	An additional **319** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 113,422,873**	**$ 18,867,656** spent	A savings of **$ 62,109,898**	A further increase of **$ 51,313,008** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 27,749** for each ton of emissions increased	**$ 12,588** spent for each ton of emissions increased	A savings of **$ 16,483** for each ton of emissions increased	An additional **$ 160,699** spent for each additional ton of emission reductions not lost through exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-13. Exempting at 40% Targeting[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Targeted Vehicles [c] at 40% Targeting (N)		5,355,228	1,621,355	5,355,228	
Targeted Vehicles that Fail ASM at Decision Point (N)		128,372	21,297	113,785	14,586 fewer failing vehicles to be exempted
ASM Fail Rate at Decision Point (%)		2.4%	1.3%	2.1%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	An increase of **349,047,547** failed miles driven	An increase of **134,431,410** failed miles driven	An increase of **291,006,737** failed miles driven	The reduction of an additional **58,040,810** failed miles driven are preserved
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	An increase of **6,155** tons	An increase of **2,140** tons	An increase of **5,774** tons	An additional **381** tons of emissions reductions are preserved
Total Costs ($/2years)		A savings of **$ 151,344,918**	**$ 7,031,889** spent	A savings of **$ 100,374,330**	A further increase of **$ 50,970,591** spent
Cost Effectiveness ($/ton HC+NOx) [h]		A savings of **$ 24,588** for each ton of emissions increased	**$ 3,287** spent for each ton of emissions increased	A savings of **$ 17,384** for each ton of emissions increased	An additional **$ 133,655** spent for each additional ton of emission reductions not lost through exemption from exemption

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-14. Scrapping for an $8 Million Biennial Vehicle Purchase Budget[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID alone causes:**
Targeted Vehicles [c] (N)		33,470	23,104	30,793	
Targeted Vehicles that Fail ASM at Decision Point (N)		13,117	10,524	12,910	207 fewer vehicles to fail
ASM Fail Rate at Decision Point (%)		39.2%	45.5%	41.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **107,628,709** failed miles driven	A decrease of **92,656,050** failed miles driven	A decrease of **109,617,431** failed miles driven	A further decrease of **1,988,722** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **2,071** tons	A decrease of **1,643** tons	A decrease of **2,130** tons	A further decrease of **59** tons
Total Costs ($/2years)		**$ 11,201,238** spent	**$ 62,891,788** spent	**$ 63,173,689** spent	A further increase of **$ 51,972,453** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,410** spent for each ton of emissions reduced	**$ 38,289** spent for each ton of emissions reduced	**$ 29,660** spent for each ton of emissions reduced	An additional **$ 874,997** spent for each additional ton of emissions reduced
Average Market Value of Targeted Vehicles ($)		$ 609	$ 746	$ 606	

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-15. Scrapping for a $16 Million Biennial Vehicle Purchase Budget[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID alone causes:**
Targeted Vehicles [c] (N)		58,908	38,102	54,891	
Targeted Vehicles that Fail ASM at Decision Point (N)		22,936	17,388	23,020	85 more vehicles to fail
ASM Fail Rate at Decision Point (%)		38.9%	45.6%	41.9%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **190,210,114** failed miles driven	A decrease of **158,294,190** failed miles driven	A decrease of **200,080,890** failed miles driven	A further decrease of **9,870,776** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **3,478** tons	A decrease of **2,566** tons	A decrease of **3,612** tons	A further decrease of **135** tons
Total Costs ($/2years)		**$ 18,728,744** spent	**$ 70,487,724** spent	**$ 71,056,304** spent	A further increase of **$ 52,327,563** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,385** spent for each ton of emissions reduced	**$ 27,468** spent for each ton of emissions reduced	**$ 19,670** spent for each ton of emissions reduced	An additional **$ 388,824** spent for each additional ton of emissions reduced
Average Market Value of Targeted Vehicles ($)		$ 683	$ 903	$ 694	

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-16. Scrapping for a $32 Million Biennial Vehicle Purchase Budget[a]

		Vehicle Selection Method			Adding RSD to VID alone causes:
		VID alone	**RSD alone**	**VID+RSD together**	
Targeted Vehicles [c] (N)		109,782	60,801	96,394	
Targeted Vehicles that Fail ASM at Decision Point (N)		41,237	27,431	39,637	1,599 <u>fewer</u> vehicles to fail
ASM Fail Rate at Decision Point (%)		37.6%	45.1%	41.1%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **339,431,965** failed miles driven	A decrease of **254,041,479** failed miles driven	A decrease of **343,861,774** failed miles driven	A further decrease of **4,429,809** failed miles driven
	Total ΔFTP HC+NOx (tons/2years) [f]	A decrease of **5,992** tons	A decrease of **3,858** tons	A decrease of **5,913** tons	A <u>smaller</u> decrease by **79** tons
Total Costs ($/2years)		**$ 34,850,021** spent	**$ 84,061,842** spent	**$ 86,343,758** spent	A further increase of **$ 51,493,748** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 5,816** spent for each ton of emissions reduced	**$ 21,791** spent for each ton of emissions reduced	**$ 14,602** spent for each ton of emissions reduced	An additional **$ 649,945** spent for each additional ton of emissions <u>increased</u>
Average Market Value of Targeted Vehicles ($)		$ 774	$ 1,080	$ 798	

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table A-17. Scrapping for a $64 Million Biennial Vehicle Purchase Budget[a]

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID alone causes:**
Targeted Vehicles [c] (N)		200,821	109,441	174,045	
Targeted Vehicles that Fail ASM at Decision Point (N)		70,526	47,529	68,379	2,147 fewer vehicles to fail
ASM Fail Rate at Decision Point (%)		35.1%	43.4%	39.3%	
Benefits	**Δ Failed Miles Driven (miles/2years) [d]**	A decrease of **566,689,602** failed miles driven	A decrease of **447,075,412** failed miles driven	A decrease of **588,617,261** failed miles driven	A further decrease of **21,927,659** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years) [f]**	A decrease of **9,505** tons	A decrease of **6,294** tons	A decrease of **9,532** tons	A further decrease of **27** tons
Total Costs ($/2years)		**$ 67,128,457** spent	**$ 117,865,746** spent	**$ 118,483,138** spent	A further increase of **$ 51,354,683** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 7,062** spent for each ton of emissions reduced	**$ 18,727** spent for each ton of emissions reduced	**$ 12,430** spent for each ton of emissions reduced	An additional **$ 1,930,215** spent for each additional ton of emissions decreased
Average Market Value of Targeted Vehicles ($)		$ 906	$ 1,345	$ 937	

[a] The costs and benefits presented in this table are for a large RSD measurement program that obtains valid, DMV-matched RSD readings on 50% of the on-road vehicles driving in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Appendix B
Effects of Varying RSD Program Coverage

Table B-1. Four-Strategy Package for a 10% Any-VSP RSD Coverage Program [b1]

		Vehicle Selection Method			Adding RSD to VID-alone causes:
		VID alone	RSD alone	VID+RSD together	
Calling-In	Targeted Vehicles [c] at 5% Targeting (N)	669,403	31,292	669,403	
	Targeted Vehicles that Fail ASM at Decision Point (N)	222,039	13,624	224,164	
	ASM Fail Rate at Decision Point (%)	33.2%	43.5%	33.5%	
Directing	Targeted Vehicles [c] at 40% Targeting (N)	5,355,228	250,332	5,355,228	
	Δ^i Targeted Vehicles that Fail ASM at Decision Point (N)	115,080	6,366	115,952	
	Δ^i ASM Fail Rate at Decision Point (%)	2.1%	2.5%	2.2%	
Exempting	Targeted Vehicles [c] at 20% Targeting (N)	2,677,614	125,166	2,677,614	
	Targeted Vehicles that Fail ASM at Decision Point (N)	58,371	1,092	57,201	
	ASM Fail Rate at Decision Point (%)	2.2%	0.9%	2.1%	
Scrapping	Targeted Vehicles [c] for 16M$ Purchase Budget (N)	58,908	24,407	58,908	
	Targeted Vehicles that Fail ASM at Decision Point (N)	22,936	10,195	23,200	
	ASM Fail Rate at Decision Point (%)	38.9%	41.8%	39.4%	

[b1] The small RSD program (10% any-VSP RSD coverage) will provide VSP-qualified RSD readings on 625,831 vehicles subject to I/M in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table B-1 (continued).

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Benefits	**Δ Failed Miles Driven (miles/2years)** [d]	A decrease of **1,613,638,558** failed miles driven	A decrease of **134,963,201** failed miles driven	A decrease of **1,632,606,440** failed miles driven	A further decrease of **18,967,883** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years)** [f]	A decrease of **10,053** tons	A decrease of **1,517** tons	A decrease of **10,208** tons	A further decrease of **155** tons
Total Costs ($/2years)		**$ 32,599,772** spent	**$ 23,512,637** spent	**$ 36,192,229** spent	A further increase of **$ 3,592,457** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 3,243** spent for each ton of emissions reduced	**$ 15,494** spent for each ton of emissions reduced	**$ 3,545** spent for each ton of emissions reduced	An additional **$ 23,184** spent for each additional ton of emissions reduced

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table B-2. Four-Strategy Package for a 30% Any-VSP RSD Coverage Program[b2]

		Vehicle Selection Method			
		VID alone	RSD alone	VID+RSD together	Adding RSD to VID-alone causes:
Calling-In	Targeted Vehicles [c] at 5% Targeting (N)	669,403	107,873	669,403	
	Targeted Vehicles that Fail ASM at Decision Point (N)	222,039	46,965	229,366	
	ASM Fail Rate at Decision Point (%)	33.2%	43.5%	34.3%	
Directing	Targeted Vehicles [c] at 40% Targeting (N)	5,355,228	862,985	5,355,228	
	Δ^{i} Targeted Vehicles that Fail ASM at Decision Point (N)	115,080	21,946	118,086	
	Δ^{i} ASM Fail Rate at Decision Point (%)	2.1%	2.5%	2.2%	
Exempting	Targeted Vehicles [c] at 20% Targeting (N)	2,677,614	431,492	2,677,614	
	Targeted Vehicles that Fail ASM at Decision Point (N)	58,371	3,764	54,338	
	ASM Fail Rate at Decision Point (%)	2.2%	0.9%	2.0%	
Scrapping	Targeted Vehicles [c] for 16M$ Purchase Budget (N)	58,908	32,362	56,230	
	Targeted Vehicles that Fail ASM at Decision Point (N)	22,936	14,600	22,773	
	ASM Fail Rate at Decision Point (%)	38.9%	45.1%	40.5%	

[b2] The medium RSD program (30% any-VSP RSD coverage) will provide VSP-qualified RSD readings on 2,157,461 vehicles subject to I/M in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table B-2 (continued).

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Benefits	**Δ Failed Miles Driven (miles/2years)** [d]	A decrease of **1,613,638,558** failed miles driven	A decrease of **270,442,089** failed miles driven	A decrease of **1,670,391,388** failed miles driven	A further decrease of **56,752,830** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years)** [f]	A decrease of **10,053** tons	A decrease of **2,774** tons	A decrease of **10,433** tons	A further decrease of **380** tons
Total Costs ($/2years)		**$ 32,599,772** spent	**$ 38,316,134** spent	**$ 49,183,178** spent	A further increase of **$ 16,583,408** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 3,243** spent for each ton of emissions reduced	**$ 13,813** spent for each ton of emissions reduced	**$ 4,714** spent for each ton of emissions reduced	An additional **$ 43,622** spent for each additional ton of emissions reduced

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Table B-3. Four-Strategy Package for a 50% Any-VSP RSD Coverage Program[b3]

		Vehicle Selection Method			
		VID alone	RSD alone	VID+RSD together	Adding RSD to VID-alone causes:
Calling-In	Targeted Vehicles [c] at 5% Targeting (N)	669,403	202,669	669,403	
	Targeted Vehicles that Fail ASM at Decision Point (N)	222,039	88,237	235,806	
	ASM Fail Rate at Decision Point (%)	33.2%	43.5%	35.2%	
Directing	Targeted Vehicles [c] at 40% Targeting (N)	5,355,228	1,621,355	5,355,228	
	Δ^{i} Targeted Vehicles that Fail ASM at Decision Point (N)	115,080	41,232	120,727	
	Δ^{i} ASM Fail Rate at Decision Point (%)	2.1%	2.5%	2.3%	
Exempting	Targeted Vehicles [c] at 20% Targeting (N)	2,677,614	810,678	2,677,614	
	Targeted Vehicles that Fail ASM at Decision Point (N)	58,371	7,071	50,794	
	ASM Fail Rate at Decision Point (%)	2.2%	0.9%	1.9%	
Scrapping	Targeted Vehicles [c] for 16M$ Purchase Budget (N)	58,908	38,102	54,891	
	Targeted Vehicles that Fail ASM at Decision Point (N)	22,936	17,388	23,020	
	ASM Fail Rate at Decision Point (%)	38.9%	45.6%	41.9%	

[b3] The large RSD program (50% any-VSP RSD coverage) will provide VSP-qualified RSD readings on 4,053,388 vehicles subject to I/M in the five largest AQMDs.

[c] of 13,388,069 vehicles in the I/M fleet.

[i] Inspecting targeted vehicles at high-performing stations rather than at average-performing stations causes these increases in the number of targeted vehicles that fail and corresponding increases in ASM fail rates.

Table B-3 (continued).

		Vehicle Selection Method			
		VID alone	**RSD alone**	**VID+RSD together**	**Adding RSD to VID-alone causes:**
Benefits	**Δ Failed Miles Driven (miles/2years)** [d]	A decrease of **1,613,638,558** failed miles driven	A decrease of **412,353,033** failed miles driven	A decrease of **1,723,073,029** failed miles driven	A further decrease of **109,434,472** failed miles driven
Benefits	**Total ΔFTP HC+NOx (tons/2years)** [f]	A decrease of **10,053** tons	A decrease of **3,920** tons	A decrease of **10,828** tons	A further decrease of **775** tons
Total Costs ($/2years)		**$ 32,599,772** spent	**$ 78,358,444** spent	**$ 87,230,874** spent	A further increase of **$ 54,631,106** spent
Cost Effectiveness ($/ton HC+NOx) [h]		**$ 3,243** spent for each ton of emissions reduced	**$ 19,990** spent for each ton of emissions reduced	**8,056** spent for each ton of emissions reduced	An additional **$ 70,526** spent for each additional ton of emissions reduced

[d] of 30,624,179,635 total Failed Miles Driven over 2 years by 13,388,069 vehicles in the I/M fleet.

[f] of 605,088 total tons of FTP HC + NOx emissions in 2 years by 13,388,069 vehicles in the I/M fleet.

[h] Compare cost-effectiveness values to the Carl Moyer criterion of $14,300 spent for each ton of HC+NOx emissions reduced.

Attachment H

2006 Final Report, Bureau of Automotive Repair, Enforcement Monitor

Title

2006 Final Report
Bureau of Automotive Repair
Enforcement Monitor

Presented to

Department of Consumer Affairs and
Joint Committee on Boards, Commissions and
Consumer Protection

date

December 15, 2006

BAR
Bureau of Automotive Repair
DRIVE SMART CALIFORNIA

Management Auditing
Process improvement
Strategic planning
Performance measurement
Financial analysis
Organizational design

STRATEGICA INC.

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PROJECT SUMMARY

This project is an outgrowth of the 2003 Sunset Review process that focused on the Bureau of Automotive Repair (BAR). After the Sunset Review the California Legislature passed Senate Bill 1542 (Figueroa) (SB 1542) establishing the position of Enforcement Monitor for a two-year period. This project got started in April 2005 and will end in December 2006 with the third and final report. This is the first report.

Our initial investigatory work and discussions with project stakeholders resulted in a line of inquiry focusing on six key questions. These questions incorporated the objectives of SB 1542 as well as stakeholder expectations and are used as an organizing principle for this report. These questions are:

1. Does the BAR disciplinary process provide for due process?
2. Should the Repair Act include a specific definition of fraud?
3. Are regulators enforcing documentation and paperwork standards that don't exist?
4. Is the system of sanctions commensurate with the degree of violation?
5. Should the BAR be in the business of setting and enforcing trade standards?
6. Is the BAR doing enough to prevent violations other than applying sanctions?

Does the BAR disciplinary process provide for due process?

The BAR disciplinary system has come under criticism from industry for being stacked against licensees[1] involved in investigations and disciplinary actions. These criticisms include:

- Proposed decisions, made by Administrative Law Judges (ALJs) after an administrative hearing, can be rejected by the Director of DCA and a new decision can be rendered. Members of industry and the defense bar feel that this provision, called a non-adopt, creates a natural bias against the licensee's case because the mission of DCA is consumer protection. In addition, because the DCA Director is not present at the administrative hearing, a final decision is rendered without the benefit of hearing testimony first-hand or observing witnesses.

- Besides the non-adopt provision, other barriers to seeking a fair hearing include no possibility of recovering the cost of a defense and being required to pay the BAR's investigation costs for the case. Also, the options for discovery available to a licensee

[1] Auto repair dealers are "registrants" and smog check stations and technicians are "licensees." Since many of the findings and recommendations in this report apply to both, for convenience the term "licensee" is used for both types of businesses.

under state law are restricted. Finally, the record inspection provision in the Repair Act is considered to be heavy-handed and a violation of due process.

The issue of what due process is required in regulatory systems such as the BAR has been addressed by various courts including the U.S. Supreme Court. These courts found:

- States can condition the right to enter a profession or trade if there is a compelling public interest. Under this scenario the right becomes more of a privilege and the license is subject to the rules of the regulatory program,
- The federal Constitution does not guarantee full due process in administrative hearings. Only notice and the right to a hearing are guaranteed. However, regulatory schemes and their administration cannot be unreasonable, arbitrary or capricious,
- Case law allows an agency head to adjudicate a case falling within his/her jurisdiction despite the appearance of a conflict of interest. The law assumes that agency adjudicators are impartial in the absence of evidence to the contrary, and
- Warrantless searches, which is what BAR program reps do during record inspections, are legal insofar as the statute authorizing them supports a legitimate regulatory interest of the state and there are sufficient safeguards against the searches getting out of hand.

In our observations and case auditing, we found that the BAR staff conducted the program in a professional but firm manner. Cases were well prepared and field staff conducted themselves appropriately.

The Legislature, DCA and the BAR should work to improve some of the due process safeguards even if the current system passes constitutional muster:

- Exclude the non-adopt option from the BAR's use of the Administrative Procedure Act. Even though the non-adopt option is legal, it helps create a stacked system, is infrequently used, and creates a barrier for licensees seeking a fair hearing on a licensure issue,
- The regulations should allow licensees to recover legal fees if a substantial majority of allegations in an accusation are not proven, and
- The role of the ombudsman should be strengthened so they have more authority and independence in investigatory and discipline matters.

Should the Repair Act include a specific definition of fraud?

The Repair Act includes several acts of conduct that are grounds for sanctioning or revoking a license. Two of these acts delve into the realm of constructive fraud. Constructive fraud is similar to actual fraud except it doesn't require the element of intent to defraud. Constructive fraud usually occurs in a context of a fiduciary or contractual relationship (e.g., an auto repair transaction) where there is a presumed duty to disclose any information that would impact the transaction (e.g., the true condition of the vehicle.) The problem with these provisions is that they can potentially snare one-time mistakes in the same net as more insidious, repeated acts of constructive fraud. Unless the agency can determine whether the "mistakes" are part of a pattern it is difficult to tell the difference.

Because California laws other than the Repair Act apply the concept of constructive fraud on the auto repair industry (i.e., the Civil Code applies the concept to contracts), it is hard to argue that the concept applies in some situations, such as the validity of a repair contract, but not other situations, such as the licensee's fitness to hold the license.

A bigger issue is the difficulty of understanding the concept of constructive fraud, how the line is crossed between honest mistake and constructive fraud, and how to avoid crossing that line. The BAR should provide more clarity and guidance through a pre-licensing voluntary educational and mandatory testing program for all licensees.

Are regulators enforcing documentation and paperwork standards that don't exist?

This question can also address whether the BAR is enforcing rules that are divorced from the original intent of the Repair Act and the Health and Safety (H&S) Code. These two statutes include many seemingly persnickety rules and regulations covering such things as what information goes into a work estimate, what a smog technician is supposed to do under the hood of a car, etc. There has been criticism that these rule are not only irrelevant but they constitute scope creep from the original intent of the law which was to go after the bad operators and leave the good ones alone.

Besides the fact that these rules have been part of the statutes since day-one it should be acknowledged that the rules do serve a purpose. Documentation standards that require things like the correct address of an ARD on an invoice are intended to improve communication between ARDs and their customers so that the scope of potential problems and disputes is narrowed down to more substantive issues such as workmanship and fraud.

A bigger issue may be that systems used to manage estimates and other documentation frequently lacks functions to fully comply with the law. The Enforcement Monitor noted that these systems are not always programmed or installed correctly causing many inadvertent violations of the Act. Conversely, a well functioning system can not only benefit the consumer by improving the quality of the transaction but can reduce risk for the shop owner.

The BAR does not have a proactive process or program for working with shop management software providers to improve the functionality of their systems. Short of providing any guarantees or warranties, the BAR should implement a program of scheduled or ad-hoc technical conferences for shop management software providers focusing on improving the software and compliance. In addition, the BAR should offer and provide technical reviews of software products on request.

Is the system of sanctions commensurate with the degree of violation?

We conducted an audit of BAR cases to determine:

1. Do non-adopt decisions result in greater sanctions?
2. Do cases get resolved with greater sanctions than the guidelines allow?
3. Do cases get resolved with greater sanctions than the facts would warrant?

We found:

- Non-adopt decisions frequently result in greater sanctions (17 out of 26 non-adopt cases over the last three years.) This lends credence to industry concerns that a hearing is risky and will not be fairly adjudicated.

- All cases are resolved within guidelines and are even frequently sanctioned less than the guidelines. In fact, two of the non-adopt cases in the sample were ultimately decided at less than what the guidelines call for.
- In nearly all the cases, the sanctions applied appeared to match the severity of the proven allegations and were consistent with other cases with similar facts and circumstances.

Should the BAR be in the business of setting and enforcing trade standards?

The Repair Act and the H&S Code are mostly silent on what constitutes trade standards even though the BAR files disciplinary actions citing trade standard violations. Defining trade standards would eliminate discretion for repair technicians and vastly expand the scope of BAR's regulatory activities and is not in the best interests of the State. One exception to this involves brake diagnosis. Interview feedback suggests that standards for diagnosing brake problems and communicating these problems to consumers would be helpful by instilling a higher level of objectivity and specificity in brake problem diagnoses and giving consumers a more informed basis for making repair decisions. The BAR should convene a committee of regulators, consumer advocates and industry representatives to explore the feasibility of brake diagnosis standards. A model for this regulation is found in the Findings and Recommendations section of this report.

Is the BAR doing enough to prevent violations other than applying sanctions?

One area where the Repair Act is lacking enforcement capability is in licensing service writers, managing employees, and beneficial owners of ARDs. The current system of registering business entities is sometimes unable to prevent violators from re-entering the industry under another guise. The ARD license should be structured more in line with how smog check licenses are issued where actual operators are licensed in addition to the business. Key individuals should be required to pass an exam on BAR standards and regulations, be issued a license and be subject to discipline in the event of violations. BAR or a contractor could provide voluntary seminars prior to taking the exam. Existing licensees should be required to take the course and pass a test as a condition for continued licensure. This system would:

- Help ensure a minimal level of proficiency without costing industry much down time,
- Build licensee's awareness of what the standards are, how they can be complied with, the business benefits of compliance, and how the BAR operates,
- Provide a greater incentive to adhere to the Auto Repair Act and the H&S Code because individuals will be personally accountable for their actions in addition to the business entity,
- Allow more accurate targeting of sanctions to the responsible parties. This can be a real advantage when addressing a large ARD like a dealership, and
- Provide that those who financially benefit from violations can be disciplined with more consistency than is currently the case.

Additional Areas of Investigation

Limitations – State law contains statutes (B&P 9889.8 and H&S 44072.7) setting time limits for filing accusations against brake and lamp stations and smog check stations. Except for cases of fraud, these statutes set a limit of three years between the date of a violation and the date an accusation is filed.[2] There has been a general presumption that B&P 9889.8 applied to all ARD disciplinary cases. However, a careful reading of the statute will reveal that the statute only applies to brake and lamp stations. The result is that, in fact, there is no limitation that applies to other ARDs. The Legislature should amend the B&P Code to include limitations for consumer protection cases filed under B&P Section 9884 modeled after the existing limitation statutes.

Minimal Penalty Guidelines – Title 16 of the CCR contains penalty guidelines for violations of key provisions in the B&P and H&S Codes. In some cases there is a wide disparity in these guidelines between provisions addressing smog check violations and auto repair violations. These encompass violations addressing preparation of estimates and invoices. Fortunately, the BAR has prepared and submitted a Regulation Change Proposal dated 12/28/05 that clears up these disparities along with some additional clarifications in the guidelines. We recommend the State adopt this Regulation Change Proposal.

Arbitration – Binding arbitration (mandatory and/or voluntary) was investigated for its potential in resolving some portion of the consumer complaint workload. Unfortunately, the potential cost of arbitration and the BAR's prior experience with the technique do not favor its successful implementation and we are not recommending its adoption.

Program Rep Training – The Enforcement Monitor reviewed the scope of program representative training programs and attendance data. The programs were found to be broad in scope covering a range of technical and policy subjects and were well attended.

Charging Timelines – An analysis of actual timeliness data for investigating and charging BAR disciplinary cases show that, on average, cases are charged within statutory deadlines. The average case is filed within 348 days[3] and decisions are reached within 797 days.[4] In addition to charging disciplinary cases, the BAR mediates complaints in 35 days on average.

Unlicensed Activity – The BAR dedicates 12 staffpersons to the problem of unlicensed auto repair businesses (most "unlicensed" businesses are just delinquent in renewing). These staffpersons utilize a combination of in-house search techniques and field inspections to identify and enforce against unlicensed businesses. The unit demonstrates a high rate of success in achieving compliance.

[2] There is no clear legal definition of what it means to file an accusation but it is generally understood to mean the date that an accusation is signed by the BAR Chief. The law could probably benefit from additional clarity in this area as well.
[3] As mentioned earlier, the standard is three years except for cases of fraud.
[4] Once a case is filed, the timeline is controlled by the Attorney General and the Office of Administrative Hearings.

INTRODUCTION

Mission of the BAR

The mission of the BAR is to protect and serve California consumers by ensuring a fair and competitive automotive repair marketplace and implementing a model motor vehicle air quality improvement program.

The mission of the Department of Consumer Affairs (DCA), of which the BAR is a unit, is to protect and serve consumers while ensuring a competent and fair marketplace.

A significant distinction between the two missions is the BAR's incorporation of an environmental protection goal (i.e., promoting air quality) in it's mission where the DCA mission focuses solely on consumer protection. The BAR air quality enhancement goal is implemented through the Bureau's enforcement of smog check station rules and procedures.

History of the BAR

The Automotive Repair Act was passed 1971 through Senate Bill 51 (SB51) (Beilenson). The act mandated a statewide consumer protection program for the auto repair industry and a system of registering auto repair dealers (ARDs). In 1972 the BAR was established within the Department of Consumer Affairs (DCA). The Automotive Repair Act was codified in Business & Professions Code (B&P Code), Chapter 20, sections 9880 et seq.

In 1977, amendments to the Federal Clean Air Act required those states not meeting air quality standards to implement Inspection and Maintenance (I/M) programs whereby vehicles would be tested for compliance with emission standards at smog check facilities. In 1982 the BAR was given responsibility for enforcing smog check station rules and standards.

In 2003, a Sunset Review[5] was conducted that attracted significant interest from the auto repair and smog check industry. Extensive criticism was directed at agency management for what was perceived to be heavy-handed enforcement tactics, constricted due process rights and insensitivity towards the concerns of the industry. In response the state legislature sponsored Senate Bill 1542 (SB 1542) (Figueroa) to establish the position of

[5] Sunset reviews are conducted periodically by state government to determine if a program is meeting the objectives of the enabling legislation, operating efficiently or accomplishing it's mission. Usually a sunset review coincides with a pre-programmed opportunity to either reauthorize the existence of the program, change it or shut it down.

Enforcement Monitor to investigate the claims put forth by industry and evaluate the fairness of the agency's practices. Enforcement monitors have been appointed for other state consumer protection boards and bureaus in the past so the appointment of a monitor for the BAR was not unprecedented for state government.

Snapshot of the BAR

The BAR employs 551 staff in 12 field offices around the state in addition to the Sacramento headquarters. These field offices allow BAR staff to be close to licensees[6] and consumers. The BAR also has seven documentation labs where state-owned vehicles are prepared for conducting undercover operations.

About half of the staff are employed as Program Representatives, a title denoting an investigator that responds to, and investigates complaints, conducts formal investigations, pursues disciplinary actions. Program reps also provide formal and informal coaching and education for members of industry on ways to comply with auto repair and smog check regulations.

The agency is organized functionally with three major divisions:

- Smog Check Engineering and Operations,
- Consumer Assistance and Administration, and
- Field Operations and Enforcement.

Most of the activity addressed by the Enforcement Monitor project occurs in the Field Operations and Enforcement Division.

Legal authority for BAR operations is found in three main sources:

- B&P Code 9880 et seq. – commonly called the Auto Repair Act. This series of statutes covers the consumer protection part of the BAR. This statute was originally passed in 1971.
- Health & Safety (H&S) Code Sections 44000 et seq. – This series of statutes covers the oversight of smog check stations. The portion most relevant to the BAR and this project is Section 44014 et seq.
- These statutes are backed up by regulations found in Chapter 1, Division 33 of Title 16 of the California Code of Regulations (CCR).

The BAR is a self-supporting agency and does not rely on state general fund support. In FY 2003-04 the BAR had a budget of $108 million. Key revenue sources include smog check fees paid by consumers and licensing fees paid by ARDs and smog, lamp and brake stations and technicians.

[6] Auto repair dealers are "registrants" and smog check stations and technicians are "licensees." Since many of the findings and recommendations in this report apply to both, for convenience the term "licensee" is used for both types of businesses.

Key workload statistics include (all figures are for FY 2005-06 unless otherwise noted):[7]

- 42,500 registered ARDs (these include smog check stations which are required to have an ARD registration as well as a smog check facility license)
- 800 educational presentations held
- 17,000 complaints received
- 16,800 complaints closed
- 6,700 complaints referred to BAR field offices for investigation
- Top 3 complaint categories:
    1. Auto body/auto glass repair
    2. Steering/brake repair
    3. Transmission repair
- 28,400 inspections of smog check facilities[8]
- 1,300 investigations of auto repair and smog check locations[9]
- 770 office/citation conferences held for ARDs
- 800 citations issued to smog check licensees with total amount fined of $275,000
- 104 cases referred to the Attorney General for disciplinary action
- 69 cases referred to local prosecutors for criminal prosecution
- 177 stipulated settlements
- 199 licenses revoked

Project objectives

Objectives for the Enforcement Monitor program were covered in SB 1542, the bill authorizing the Enforcement Monitor. The specific language of the bill is shown in Appendix 2 but is summarized below:

- Examine the accuracy and consistency in the application of sanctions or discipline,
- Evaluate the viability and fairness of procedures available to licensees and registrants to respond to allegations of violations,
- Evaluate the accessibility, fairness and independence of the appeals process,
- Evaluate the prioritization of investigatory and prosecutory resources,
- Evaluate the expertise of bureau staff in accepted industry standards,
- Evaluate the effectiveness of DCA's ombudsman and advisory committee,

[7] Most numbers are approximations.
[8] Smog check stations are inspected twice a year.
[9] The majority of investigations are triggered by complaints (in the case of auto repair establishments) or evidence of compliance issues (in the case of smog check stations).

- Analyze and consider a statutory definition of the term "fraud" and how it applies to licensees and registrants,
- Analyze and consider the establishment of formal diagnostic and repair standards,
- Analyze and consider the licensing or registration of technicians,
- Consider the establishment of a formal code of conduct, and
- Evaluate the processing of complaints and investigations.

Procedures performed

Strategica, Inc. performed the following procedures during the Enforcement Monitor project to date:

- Conducted an entrance conference,
- Met industry stakeholders at a series of forums held throughout the state,
- Interviewed 45 BAR employees, legislative staffers, prosecutors, industry representatives, defense attorneys, consumer advocates,
- Read 34 reports and other documents (e.g., BAR plans, reports and letters from industry reps, educational materials, statutes & regulations),
- Developed an essential elements of due process list and compared it to the Administrative Procedure Act (APA),
- Conducted 12 ridealongs with BAR program reps and observations of office conferences and administrative hearings,
- Observed DCA staff at 2 mediation centers,
- Mapped processes for investigating complaints and handling disciplinary matters,
- Audited 30 cases for due process, consistency in sanctions,
- Examined the legal basis for various elements of the Auto Repair Act and the APA,
- Examined features of other regulatory practices at peer agencies such as the Alcoholic Beverage Commission, the Medical Quality Board and the Contractors State License Board,
- Researched shop management software systems and contacted software publishers,
- Researched arbitration systems in California and Washington,
- Researched and drafted brake system trade standards, and
- Researched data on program representative training, unlicensed activity enforcement, charging timelines and case prioritization, and minimum penalty guidelines.

FINDINGS

The following few pages describe our updated findings on the case audit and the status of prior recommendations. There was no additional research performed since the Year Two Report was issued in June 2006. Please review this report and the December 2005 Initial Report in Appendices 3 and 4 for additional project findings.

Updated Case Audit Statistics

An extensive audit of closed disciplinary case files was conducted for the Year One report. For this final report we added six additional cases bring the total audited to 30. The following text describes updated findings for the entire sample.

The case audit sample (for all cases) had the following characteristics:

- 30 total cases

- 6 cases were resolved through stipulated settlements
- 22 cases were resolved after an administrative hearing
- 1 case was resolved ministerially by BAR
- 1 case was dismissed by the ALJ because it exceeded the limitation statute

- 7 cases were selected by the BAR[10]
- 17 cases were selected at random by the Enforcement Monitor
- 6 cases were referred by industry

- 21 cases were for auto repair dealers
- 9 cases were for smog check stations

- 7 cases were non-adopt decisions

The BAR has prepared Standard Terms and Conditions of Probation[11] that establishes a range of sanctions for common violations of the Repair Act and the Health & Safety Code. For example, the range of sanctions for violating B&P Code 9884.7(a)(1), making false and misleading statements, would be revocation on the high end and a 10-day suspension[12] plus 2 years of probation on the low end. Like most sentencing guidelines used in judicial environments, the disciplinary guidelines are intended to instill consistency in how sanctions are applied so that there is a greater nexus between violations and penalties.

[10] BAR was asked to select some cases for the sample because we wanted to review recent non-adopt cases. BAR staff were in a position to identify these cases.
[11] Published January 2005.
[12] The guidelines actually call for a 90-day suspension with 80 days stayed or reduced.

Status of Prior Recommendations

The following pages list the recommendations from the Initial Report and the Year Two report and the status of implementation. Note that Recommendation 8 has been changed from the Initial Report. Recommendations 5 and 6 were dropped.

Recommendation 1 – The Legislature should exclude the non-adopt provision from the Auto Repair Act. Status: No progress. Note this recommendation requires legislation.

Recommendation 2 – The BAR should amend office conference reports to include an acknowledgement at the end of the report regarding the attendee's understanding of what was discussed and the purposes of the conference. Status: Complete.

Recommendation 3 – The Legislature should amend B&P Code 125.3 directing DCA to pay all actual legal fees incurred by licensees where the BAR was not able to prove a substantial number of the allegations in an administrative hearing. Status: No progress. Note this recommendation requires legislation.

Recommendation 4 – DCA should enhance the guidelines and authority of the ombudsman. Status: The specific responsibilities of the ombudsman are still being evaluated. Input is being sought from industry representatives.

Recommendation 7 – The BAR should implement recommendations from the Auto Body Repair Inspection Pilot Program Report to the Legislature. Status: The Auto Body Inspection Program was reinstated in November 2006. This included establishing a 1-800 phone number for consumers to request inspections of collision repairs by BAR representatives.

Recommendation 8 – The BAR and the Legislature should establish a system of required testing and licensing for service writers covering basic knowledge and application of the Auto Repair Act and sound business practices. Provide training on tested material on a voluntary basis through classroom, on-site or self-directed methods. In addition, at least one beneficial owner of an ARD should be licensed. Status: No progress.

Recommendation 9 – The BAR should implement annual or semi-annual technical conferences for shop management software providers. Offer technical reviews of software products on request. Status: No progress.

Recommendation 10 – The BAR should convene a committee of regulators, consumer advocates and industry to explore the feasibility of regulations on brake standards. Status: No progress.

Recommendation 11 – The Legislature should amend the Auto Repair Act to include limitations for CPO filings in Section 9884 of the B&P Code. Status: No progress. Note this recommendation requires legislation.

Recommendation 12 – The BAR should continue pursuing adoption of the Regulation Change Proposal to improve and clarify the disciplinary guidelines. Status: The Proposal is currently in the review and comment stage. Implementation should occur in 2007.

IV. APPENDICES

1. List of acronyms
2. Text of SB 1542 (Figueroa)
3. Initial Report (12/20/05)
4. Year Two Report (6/9/06)

Attachment H

Appendix 1
List of Acronyms

ALJ	Administrative Law Judge
APA	Administrative Procedure Act
ARD	Automotive Repair Dealer
BAR	Bureau of Automotive Repair
B&P Code	Business and Professions Code
CCR	California Code of Regulations
DCA	California Department of Consumer Affairs
GC	Government Code
H&S Code	Health and Safety Code

Appendix 2
Text of SB 1542 (Figueroa)

BILL NUMBER: SB 1542 CHAPTERED
BILL TEXT

CHAPTER 572
FILED WITH SECRETARY OF STATE SEPTEMBER 17, 2004
APPROVED BY GOVERNOR SEPTEMBER 17, 2004
PASSED THE SENATE AUGUST 25, 2004
PASSED THE ASSEMBLY AUGUST 23, 2004
AMENDED IN ASSEMBLY JULY 23, 2004
AMENDED IN ASSEMBLY JUNE 21, 2004
AMENDED IN ASSEMBLY JUNE 14, 2004
AMENDED IN SENATE MARCH 22, 2004

INTRODUCED BY Senator Figueroa
(Coauthors: Senators Aanestad and Vincent)
(Coauthors: Assembly Members Correa, Nation, and Runner)

FEBRUARY 19, 2004

An act to amend Sections 9882 and 9884.17 of, and to add and repeal Section 9882.6 of, the Business and Professions Code, relating to automotive repair, and making an appropriation therefor.

LEGISLATIVE COUNSEL'S DIGEST

SB 1542, Figueroa. Bureau of Automotive Repair.

The Automotive Repair Act creates the Bureau of Automotive Repair in the Department of Consumer Affairs, with certain powers and duties relative to the licensing and regulation of automotive repair dealers and various other licensees. The act creates the Vehicle and Inspection Repair Fund and directs that all fees and revenues collected pursuant to the act and pursuant to the motor vehicle inspection program be deposited into the fund. Existing law requires the Joint Committee on Boards, Commissions, and Consumer Protection to hold a public hearing every 4 years to receive testimony from the Director of Consumer Affairs and the bureau, and to evaluate the bureau's effectiveness and efficiency. Existing law requires the bureau to design and approve a required sign at all automotive repair dealer locations advising the public of the bureau's telephone number and other related matters. A violation of the Automotive Repair Act is a crime.

This bill would require the sign to include the bureau's Internet address. By changing the definition of a crime, the bill would impose a state-mandated local program. The bill would make nonsubstantive changes to the provisions governing the committee's review of the bureau.

This bill would require the Director of Consumer Affairs to appoint a Bureau of Automotive Repair Administration and Enforcement Monitor by January 3, 2005, and would appropriate $184,000 from the Vehicle and Inspection Repair Fund for the 2004-05, 2005-06, and 2006-07 fiscal years to the department to contract for this position.

The bill would require the monitor to evaluate the bureau and research and analyze specified issues. The bill would require the monitor to submit a report to the director, the Secretary of State and Consumer Services Agency, the bureau, and the Legislature by June 1, 2005, and every 6 months thereafter, and to issue a final report

by December 31, 2006.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

Appropriation: yes.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Section 9882 of the Business and Professions Code is amended to read:

9882. (a) There is in the Department of Consumer Affairs a Bureau of Automotive Repair under the supervision and control of the director. The duty of enforcing and administering this chapter is vested in the chief who is responsible to the director. The director may adopt and enforce those rules and regulations that he or she determines are reasonably necessary to carry out the purposes of this chapter and declaring the policy of the bureau, including a system for the issuance of citations for violations of this chapter as specified in Section 125.9. These rules and regulations shall be adopted pursuant to Chapter 4.5 (commencing with Section 11371) of Part 1 of Division 3 of Title 2 of the Government Code.

(b) In 2003 and every four years thereafter, the Joint Legislative Sunset Review Committee shall hold a public hearing to receive testimony from the Director of Consumer Affairs and the bureau. In those hearings, the bureau shall have the burden of demonstrating a compelling public need for the continued existence of the bureau and its regulatory program, and that its function is the least restrictive regulation consistent with the public health, safety, and welfare. The committee shall evaluate and review the effectiveness and efficiency of the bureau based on factors and minimum standards of performance that are specified in Section 473.4. The committee shall report its findings and recommendations as specified in Section 473.5. The bureau shall prepare an analysis and submit a report to the committee as specified in Section 473.2.

SEC. 2. Section 9882.6 is added to the Business and Professions Code, to read:

9882.6. (a) (1) The Director of Consumer Affairs shall appoint a Bureau of Automotive Repair Administration and Enforcement Monitor no later than January 3, 2005. The director may retain a person for this position by a personal services contract. The Legislature hereby finds, pursuant to Section 19130 of the Government Code, that this is a new state function.

(2) The director shall supervise the administration and enforcement monitor and may terminate or dismiss him or her from this position.

(b) The director shall advertise the availability of this position. The requirements for this position shall include experience in the performing of audits of or operating state administrative regulatory agencies, familiarity with state laws, rules, and procedures pertaining to the bureau, and familiarity with the relevant administrative procedures.

(c) (1) The administration and enforcement monitor shall evaluate the bureau's disciplinary system and procedures, with specific concentration on improving the overall efficiency and assuring the fairness of the enforcement program, and the need for administrative structural changes. The director shall specify further duties of the monitor.

(2) This monitoring duty shall be on a continuing basis for a period of no more than two years from the date of the administration and enforcement monitor's appointment and shall include, but not be limited to, researching and analyzing the following:

(A) The appropriate authorization for, accuracy of, and consistency in, the application of sanctions or discipline imposed on licensees or registrants.

(B) The viability and fairness of procedures available to licensees and registrants to respond to allegations of violations prior and subsequent to formal and/or other disciplinary actions being taken.

(C) The accessibility, fairness, and independence of the appeals process for licensees and registrants at all levels of the disciplinary process, including procedures to respond to allegations before and after formal and/or other disciplinary actions are taken.

(D) The prioritization of investigatory and prosecutory resources, particularly with respect to cases involving significant consumer harm.

(E) The adequacy of expertise of bureau staff in accepted industry standards, practices, and the applicable state and federal laws.

(F) The effectiveness of the Bureau's Industry Ombudsman and Advisory Committee, particularly in relation to their communication with licensees, registrants, and the public.

(G) The effectiveness of the bureau's cooperation with other governmental entities charged with enforcing related laws and regulations regarding automotive repair dealers and smog check stations and technicians.

(H) The creation of a statutory definition of the term "fraud."

(I) The establishment of formal diagnostic and repair standards.

(J) The licensing or registration of technicians working within the various fields of automotive repair.

(K) The establishment in regulation of a formal code of conduct for automotive repair dealers and technicians.

(L) The quality, consistency, and speed of complaint processing and investigation, and recommendations for improvement.

In performing his or her monitoring duties, the administration and enforcement monitor shall confer with, and seek input from, bureau staff, registered or licensed professionals, the Office of the Attorney General, members of the public, and other interested or relevant parties regarding their concerns and views on the bureau and its operations.

(3) The administration and enforcement monitor shall exercise no authority over the bureau's discipline operations or staff. However, the bureau and its staff shall cooperate with him or her, and the bureau shall provide data, information, and case files as requested by the administration and enforcement monitor to perform all of his or her duties.

(4) The director shall assist the enforcement program monitor in the performance of his or her duties, and the enforcement program monitor shall have the same investigative authority as the director.

(d) The administration and enforcement monitor shall submit an initial written report of his or her findings and conclusions to the bureau, the director, the Secretary of State and Consumer Services Agency, and the Legislature no later than July 1, 2005, and every six months thereafter, and be available to make oral reports if requested to do so. The administration and enforcement monitor may also provide additional information to either the director or the Legislature at his or her discretion or at the request of either the director or the Legislature. The administration and enforcement monitor shall make his or her reports available to the public or the

media. The administration and enforcement monitor shall make every effort to provide the bureau with an opportunity to reply to any facts, findings, issues, or conclusions in his or her reports with which the bureau may disagree.

(e) The administration and enforcement monitor shall issue a final report prior to December 31, 2006. The final report shall include final findings and conclusions on the topics addressed in the initial report submitted by the monitor pursuant to subdivision (d).

(f) This section shall become inoperative on April 1, 2007, and as of April 1, 2007, shall be repealed, unless a later enacted statute, which is enacted before April 1, 2007, deletes or extends the dates on which it becomes inoperative and is repealed.

SEC. 3. Section 9884.17 of the Business and Professions Code is amended to read:

9884.17. The bureau shall design and approve of a sign which shall be placed in all automotive repair dealer locations in a place and manner conspicuous to the public. That sign shall give notice that inquiries concerning service may be made to the bureau and shall contain the telephone number and Internet Web site address of the bureau. The sign shall also give notice that the customer is entitled to a return of replaced parts upon his or her request therefor at the time the work order is taken.

SEC. 4. The sum of one hundred eighty-four thousand dollars ($184,000) is hereby appropriated from the Vehicle Inspection and Repair Fund to the Department of Consumer Affairs for the 2004-05, 2005-06, and 2006-07 fiscal years for the purpose of contracting for the employment of a Bureau of Automotive Repair Administration and Enforcement Monitor pursuant to Section 9882.6 of the Business and Professions Code.

SEC. 5. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because the only costs that may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, eliminates a crime or infraction, or changes the penalty for a crime or infraction, within the meaning of Section 17556 of the Government Code, or changes the definition of a crime within the meaning of Section 6 of Article XIII B of the California Constitution.

Title

Initial Report
Bureau of Automotive Repair
Enforcement Monitor

Presented to

Department of Consumer Affairs and
Joint Committee on Boards, Commissions and
Consumer Protection

date

December 20, 2005

BAR
Bureau of Automotive Repair
DRIVE SMART CALIFORNIA

Management Auditing
Process improvement
Strategic planning
Performance measurement
Financial analysis
Organizational design

STRATEGICA INC.

Attachment H

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EXECUTIVE SUMMARY

This project is an outgrowth of the 2003 Sunset Review process that focused on the Bureau of Automotive Repair (BAR). After the Sunset Review the California Legislature passed Senate Bill 1542 (Figueroa) (SB 1542) establishing the position of Enforcement Monitor for a two-year period. This project got started in April 2005 and will end in December 2006 with the third and final report. This is the first report.

Our initial investigatory work and discussions with project stakeholders resulted in a line of inquiry focusing on six key questions. These questions incorporated the objectives of SB 1542 as well as stakeholder expectations and are used as an organizing principle for this report. These questions are:

1. Does the BAR disciplinary process provide for due process?
2. Should the Repair Act include a specific definition of fraud?
3. Are regulators enforcing documentation and paperwork standards that don't exist?
4. Is the system of sanctions commensurate with the degree of violation?
5. Should the BAR be in the business of setting and enforcing trade standards?
6. Is the BAR doing enough to prevent violations other than applying sanctions?

Does the BAR disciplinary process provide for due process?

The BAR disciplinary system has come under criticism from industry for being stacked against licensees[2] involved in investigations and disciplinary actions. These criticisms include:

- Proposed decisions, made by Administrative Law Judges (ALJs) after an administrative hearing, can be rejected by the Director of DCA and a new decision can be rendered. Members of industry and the defense bar feel that this provision, called a non-adopt, creates a natural bias against the licensee's case because the mission of DCA is consumer protection. In addition, because the DCA Director is not present at the administrative hearing, a final decision is rendered without the benefit of hearing testimony first-hand or observing witnesses.

- Besides the non-adopt provision, other barriers to seeking a fair hearing include no possibility of recovering the cost of a defense and being required to pay the BAR's investigation costs for the case. Also, the options for discovery available to a licensee under state law are restricted. Finally, the record inspection provision in the Repair Act is considered to be heavy-handed and a violation of due process.

[2] Auto repair dealers are "registrants" and smog check stations and technicians are "licensees." Since many of the findings and recommendations in this report apply to both, for convenience the term "licensee" is used for both types of businesses.

The issue of what due process is required in regulatory systems such as the BAR has been addressed by various courts including the U.S. Supreme Court. These courts found:

- States can condition the right to enter a profession or trade if there is a compelling public interest. Under this scenario the right becomes more of a privilege and the license is subject to the rules of the regulatory program,
- The federal Constitution does not guarantee full due process in administrative hearings. Only notice and the right to a hearing are guaranteed. However, regulatory schemes and their administration cannot be unreasonable, arbitrary or capricious,
- Case law allows an agency head to adjudicate a case falling within his/her jurisdiction despite the appearance of a conflict of interest. The law assumes that agency adjudicators are impartial in the absence of evidence to the contrary, and
- Warrantless searches, which is what BAR program reps do during record inspections, are legal insofar as the statute authorizing them supports a legitimate regulatory interest of the state and there are sufficient safeguards against the searches getting out of hand.

In our observations and case auditing, we found that the BAR staff conducted the program in a professional but firm manner. Cases were well prepared and field staff conducted themselves appropriately.

The Legislature, DCA and the BAR should work to improve some of the due process safeguards even if the current system passes constitutional muster:

- Exclude the non-adopt option from the BAR's use of the Administrative Procedure Act. Even though the non-adopt option is legal, it helps create a stacked system, is infrequently used, and creates a barrier for licensees seeking a fair hearing on a licensure issue,
- The regulations should allow licensees to recover legal fees if a substantial majority of allegations in an accusation are not proven, and
- The role of the ombudsman should be strengthened so they have more authority and independence in investigatory and discipline matters.

Should the Repair Act include a specific definition of fraud?

The Repair Act includes several acts of conduct that are grounds for sanctioning or revoking a license. Two of these acts delve into the realm of constructive fraud. Constructive fraud is similar to actual fraud except it doesn't require the element of intent to defraud. Constructive fraud usually occurs in a context of a fiduciary or contractual relationship (e.g., an auto repair transaction) where there is a presumed duty to disclose any information that would impact the transaction (e.g., the true condition of the vehicle.) The problem with these provisions is that they can potentially snare one-time mistakes in the same net as more insidious, repeated acts of constructive fraud. Unless the agency can determine whether the "mistakes" are part of a pattern it is difficult to tell the difference.

Because California laws other than the Repair Act apply the concept of constructive fraud on the auto repair industry (i.e., the Civil Code applies the concept to contracts), it is hard to argue that the concept applies in some situations, such as the validity of a repair contract, but not other situations, such as the licensee's fitness to hold the license.

A bigger issue is the difficulty of understanding the concept of constructive fraud, how the line is crossed between honest mistake and constructive fraud, and how to avoid crossing that line. The Legislature and the BAR should provide more clarity and guidance in statute and/or a pre-licensing educational and testing program for all licensees.

Are regulators enforcing documentation and paperwork standards that don't exist?

This question can also address whether the BAR is enforcing rules that are divorced from the original intent of the Repair Act and the Health and Safety (H&S) Code. These two statutes include many seemingly persnickety rules and regulations covering such things as what information goes into a work estimate, what a smog technician is supposed to do under the hood of a car, etc. There has been criticism that these rule are not only irrelevant but they constitute scope creep from the original intent of the law which was to go after the bad operators and leave the good ones alone.

Besides the fact that these rules have been part of the statutes since day-one it should be acknowledged that the rules do serve a purpose. Documentation standards that require things like the correct address of an ARD on an invoice are intended to improve communication between ARDs and their customers so that the scope of potential problems and disputes is narrowed down to more substantive issues such as workmanship and fraud.

Program representative checking on a consumer complaint.

A bigger issue may be that systems used to manage estimates and other documentation frequently lacks functions to fully comply with the law. In addition, many ARD operators are either unaware of don't acknowledge the rules. A mandatory, but brief, pre-licensing course and exam could resolve some of these issues.

Is the system of sanctions commensurate with the degree of violation?

We conducted an audit of BAR cases to determine:

1. Do non-adopt decisions result in greater sanctions?
2. Do cases get resolved with greater sanctions than the guidelines allow?
3. Do cases get resolved with greater sanctions than the facts would warrant?

We found:

- Non-adopt decisions frequently result in greater sanctions (17 out of 26 non-adopt cases over the last three years.) This lends credence to industry concerns that a hearing is risky and will not be fairly adjudicated.
- All cases are resolved within guidelines and are even frequently sanctioned less than the guidelines. In fact, two of the non-adopt cases in the sample were ultimately decided at less than what the guidelines call for.
- In nearly all the cases, the sanctions applied appeared to match the severity of the proven allegations and were consistent with other cases with similar facts and circumstances.

Should the BAR be in the business of setting and enforcing trade standards?

The Repair Act and the H&S Code are mostly silent on what constitutes trade standards even though the BAR files disciplinary actions citing trade standard violations. Rather than define what the trade standards should be, which would eliminate discretion for repair technicians and vastly expand the scope of BAR's regulatory activities, the Legislature and BAR should create a specialized panel of ALJs within the Office of Administrative Hearings (OAH) to better adjudicate BAR cases especially those that deal with tricky issues such as trade standards.

Is the BAR doing enough to prevent violations other than applying sanctions?

One area where the Repair Act is lacking enforcement capability is in licensing service writers, managing employees, and beneficial owners of ARDs. The current system of registering business entities is sometimes unable to prevent violators from re-entering the industry under another guise. The ARD license should be structured more in line with how smog check licenses are issued where actual operators are licensed in addition to the business. Key individuals should be required to take a short class on BAR standards, pass a test, be issued a license and be subject to discipline in the event of violations. Existing licensees should be required to take the course and pass a test as a condition for continued licensure. This system would:

- Help ensure a minimal level of proficiency without costing industry much down time,
- Build licensee's awareness of what the standards are, how they can be complied with, the business benefits of compliance, and how the BAR operates,
- Provide a greater incentive to adhere to the Auto Repair Act and the H&S Code because individuals will be personally accountable for their actions in addition to the business entity,
- Allow more accurate targeting of sanctions to the responsible parties. This can be a real advantage when addressing a large ARD like a dealership, and
- Provide that those who financially benefit from violations can be disciplined with more consistency than is currently the case.

INTRODUCTION

Organization of this report

The findings and recommendations in this report are organized according to a series of broad questions that we sought to answer. These questions, in turn, pertain to the themes that emerged during our initial survey of the Bureau of Automotive Repair (BAR.)

This introduction describes the mission of the agency, the history of the BAR, and a snapshot of what the BAR does, its workload and how it is organized. We also discuss the original objectives of this project and the methods, techniques and steps we undertook to accomplish those objectives.

Mission of the BAR

The mission of the BAR is to protect and serve California consumers by ensuring a fair and competitive automotive repair marketplace and implementing a model motor vehicle air quality improvement program.

The mission of the Department of Consumer Affairs (DCA), of which the BAR is a unit, is to protect and serve consumers while ensuring a competent and fair marketplace.

A significant distinction between the two missions is the BAR's incorporation of an environmental protection goal (i.e., promoting air quality) in it's mission where the DCA mission focuses solely on consumer protection. The BAR air quality enhancement goal is implemented through the Bureau's enforcement of smog check station rules and procedures.

History of the BAR

The Automotive Repair Act was passed 1971 through Senate Bill 51 (SB51) (Beilenson). The act mandated a statewide consumer protection program for the auto repair industry and a system of registering auto repair dealers (ARDs). In 1972 the BAR was established within the Department of Consumer Affairs (DCA). The Automotive Repair Act was codified in Business & Professions Code (B&P Code), Chapter 20, sections 9880 et seq.

In 1977, amendments to the Federal Clean Air Act required those states not meeting air quality standards to implement Inspection and Maintenance (I/M) programs whereby

vehicles would be tested for compliance with emission standards at smog check facilities. In 1982 the BAR was given responsibility for enforcing smog check station rules and standards.

In 2003, a Sunset Review[3] was conducted that attracted significant interest from the auto repair and smog check industry. Extensive criticism was directed at agency management for what was perceived to be heavy-handed enforcement tactics, constricted due process rights and insensitivity towards the concerns of the industry. In response the state legislature sponsored Senate Bill 1542 (SB 1542) (Figueroa) to establish the position of Enforcement Monitor to investigate the claims put forth by industry and evaluate the fairness of the agency's practices. Enforcement monitors have been appointed for other state consumer protection boards and bureaus in the past so the appointment of a monitor for the BAR was not unprecedented for state government.

Snapshot of the BAR

The BAR employs 551 staff in 12 field offices around the state in addition to the Sacramento headquarters. These field offices allow BAR staff to be close to licensees[4] and consumers. The BAR also has seven documentation labs where state-owned vehicles are prepared for conducting undercover operations.

About half of the staff are employed as Program Representatives, a title denoting an investigator that responds to, and investigates complaints, conducts formal investigations, pursues disciplinary actions. Program reps also provide formal and informal coaching and education for members of industry on ways to comply with auto repair and smog check regulations.

The agency is organized functionally with three major divisions:

- Smog Check Engineering and Operations,
- Consumer Assistance and Administration, and
- Field Operations and Enforcement.

Most of the activity addressed by the Enforcement Monitor project occurs in the Field Operations and Enforcement Division.

Legal authority for BAR operations is found in three main sources:

- B&P Code 9880 et seq. – commonly called the Auto Repair Act. This series of statutes covers the consumer protection part of the BAR. This statute was originally passed in 1971.
- Health & Safety (H&S) Code Sections 44000 et seq. – This series of statutes covers the oversight of smog check stations. The portion most relevant to the BAR and this project is Section 44014 et seq.

[3] Sunset reviews are conducted periodically by state government to determine if a program is meeting the objectives of the enabling legislation, operating efficiently or accomplishing it's mission. Usually a sunset review coincides with a pre-programmed opportunity to either reauthorize the existence of the program, change it or shut it down.

[4] Auto repair dealers are "registrants" and smog check stations and technicians are "licensees." Since many of the findings and recommendations in this report apply to both, for convenience the term "licensee" is used for both types of businesses.

- These statutes are backed up by regulations found in Chapter 1, Division 33 of Title 16 of the California Code of Regulations (CCR).

The BAR is a self-supporting agency and does not rely on state general fund support. In FY 2003-04 the BAR had a budget of $108 million. Key revenue sources include smog check fees paid by consumers and licensing fees paid by ARDs and smog, lamp and brake stations and technicians.

Key workload statistics include (all figures are for FY 2002-03 unless otherwise noted):[5]

- 41,000 registered ARDs (these include smog check stations which are required to have an ARD registration as well as a smog check facility license)
- 670 educational presentations held
- 23,000 complaints received
- 24,000 complaints closed
- 7,000 complaints referred to BAR field offices for investigation
- Top 3 complaint categories:
    1. Auto body/auto glass repair
    2. Steering/brake repair
    3. Transmission repair
- 21,000 inspections of smog check facilities[6]
- 2,170 investigations of auto repair and smog check locations[7]
- 581 office/citation conferences held
- 1,302 citations issued to smog check licensees with total amount fined of $457,000
- 238 cases referred to the Attorney General for disciplinary action
- 172 cases referred to local prosecutors for criminal prosecution
- 137 stipulated settlements
- 295 licenses revoked

Project objectives

Objectives for the Enforcement Monitor program were covered in SB 1542, the bill authorizing the Enforcement Monitor. The specific language of the bill is shown in Appendix 2 but is summarized below:

- Examine the accuracy and consistency in the application of sanctions or discipline,

[5] Most numbers are approximations.
[6] Smog check stations are inspected twice a year.
[7] The majority of investigations are triggered by complaints (in the case of auto repair establishments) or evidence of compliance issues (in the case of smog check stations).

- Evaluate the viability and fairness of procedures available to licensees and registrants to respond to allegations of violations,
- Evaluate the accessibility, fairness and independence of the appeals process,
- Evaluate the prioritization of investigatory and prosecutory resources,
- Evaluate the expertise of bureau staff in accepted industry standards,
- Evaluate the effectiveness of DCA's ombudsman and advisory committee,
- Analyze and consider a statutory definition of the term "fraud" and how it applies to licensees and registrants,
- Analyze and consider the establishment of formal diagnostic and repair standards,
- Analyze and consider the licensing or registration of technicians,
- Consider the establishment of a formal code of conduct, and
- Evaluate the processing of complaints and investigations.

As mentioned elsewhere, these objectives were converted into a series of key questions that provided a structure for our investigatory work and for this report. These key questions encompass the objectives of SB 1542 and the expectations of the project sponsors. These six key questions are listed on the next page.

Procedures performed

Strategica, Inc. performed the following procedures during the Enforcement Monitor project to date:

- Conducted an entrance conference,
- Met industry stakeholders at a series of forums held throughout the state,
- Interviewed 42 BAR employees, legislative staffers, prosecutors, industry representatives, defense attorneys, consumer advocates,
- Read 29 reports and other documents (e.g., BAR plans, reports and letters from industry reps, educational materials, statutes & regulations),
- Developed an essential elements of due process list and compared it to the Administrative Procedure Act (APA),
- Conducted 9 ridealongs with BAR program reps and observations of office conferences and administrative hearings,
- Observed DCA staff at 2 mediation centers,
- Mapped processes for investigating complaints and handling disciplinary matters,
- Audited 17 cases for due process, consistency,
- Examined the legal basis for various elements of the Auto Repair Act and the APA, and
- Examined features of other regulatory practices at peer agencies such as the Alcoholic Beverage Commission, the Medical Quality Board and the Contractors State License Board.

Key questions

Our initial investigatory work and discussions with project stakeholders resulted in a line of inquiry focusing on six key questions. These questions incorporated the objectives of SB 1542 as well as stakeholder expectations. These questions are:

1. Does the BAR disciplinary process provide for due process?
2. Should the Repair Act include a specific definition of fraud?
3. Are regulators enforcing documentation and paperwork standards that don't exist?
4. Is the system of sanctions commensurate with the degree of violation?
5. Should the BAR be in the business of setting and enforcing trade standards?
6. Is the BAR doing enough to prevent violations other than applying sanctions?

These questions are addressed individually in the Findings and Recommendations section. These questions cover significant portions of the BAR organization, its operations and governance.

FINDINGS AND RECOMMENDATIONS

Chapter 1 - Does the BAR disciplinary process provide for due process?

What is the BAR disciplinary process?

The disciplinary process starts with some indication that there may be compliance issues at a licensee. There are over 41,000 ARDs and smog check stations in California but only 260 program reps to regulate the industry making it necessary to only target businesses that demonstrate signs of trouble. For the automotive repair program, this trigger is usually a consumer complaint. In the smog check program, the trigger could be the findings from a semi-annual inspection or anomalies in smog check data transmitted from a smog check station.

Both programs rely on field investigation to determine if a licensee is complying with the law but the procedural steps have some differences. Appendix 3 contains maps showing the disciplinary processes used for a typical case.

Both programs also use a sliding scale of disciplinary measures with the severity of a sanction dependent on the severity of the violation. The following graphic shows this sliding scale.

Figure 1 – Sliding Scale for Sanctions – Automotive Repair

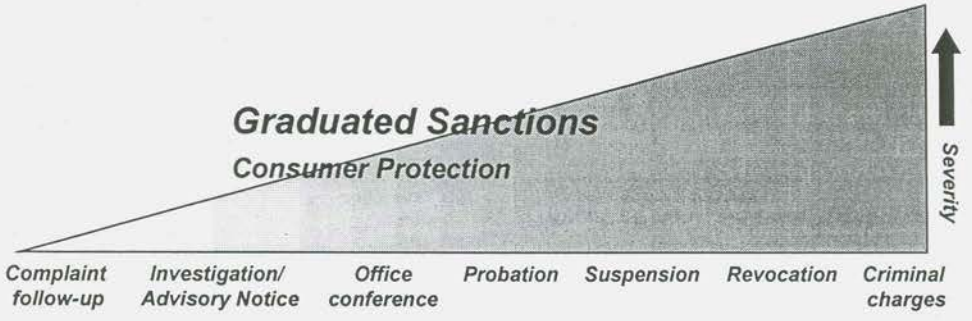
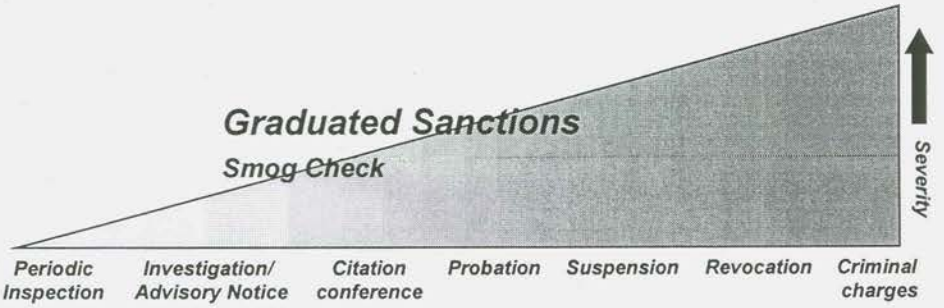
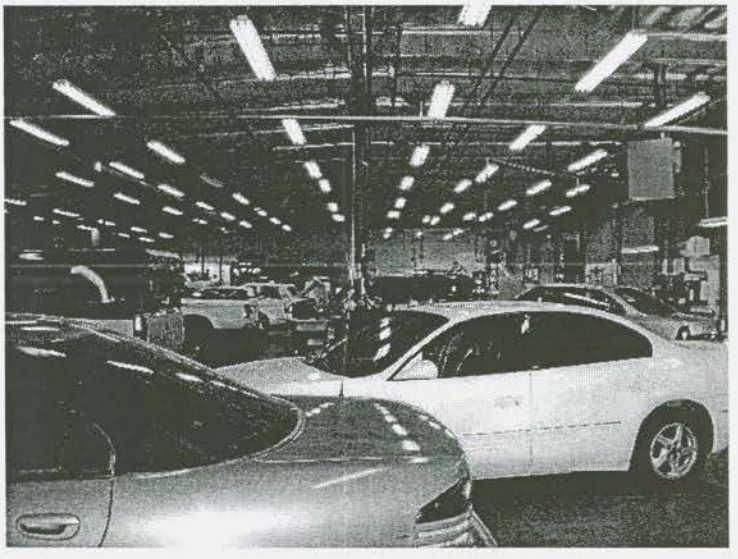


Figure 2 – Sliding Scale for Sanctions – Smog Check Program



Some elements of BAR disciplinary processes are very unique to the BAR and should be described here. In an effort to establish the "intent and design" element of fraud, the BAR will try to show that a violation is a pattern of behavior rather than a one-time mistake or slip-up. To establish this pattern at repair shops suspected of fraudulent business practices, the BAR sends vehicles with built-in operating problems or defects to the licensee being investigated. The cars are driven by undercover operators. The cars are prepared at one of seven "documentation labs" in the state. At these state-of-the-art facilities, cars are checked to ensure good running condition and then a defect is "induced" by a BAR technician. For example, the technician may induce a crack in a spark plug's insulation to induce a misfire. An undercover operator will take this vehicle to the licensee being investigated to determine if the licensee is diagnosing and communicating problems truthfully and not selling unnecessary services or parts. For example, a licensee may make false statements about the condition of a vehicle in order to sell unnecessary parts (e.g., shock absorbers) or services (e.g., engine flushing) when all that was needed were new spark plugs. Usually two or three cars are taken to the licensee to replicate the violations and prove that the violations are part of a pattern and not a mere aberration of otherwise good conduct.



View of the Sacramento Documentation Laboratory where undercover cars are prepared.

BAR investigators will also place surveillance cameras within cars to record what a technician does. This is common in the smog check program because of the requirement for smog check technicians to perform specified visual and functional inspections of a vehicle's smog control equipment, something that a hurried technician may opt to skip.

What due process is provided?

A serious violation of the Repair Act or the Health and Safety (H&S) code is usually treated as a violation of administrative law and is handled through an administrative hearing. The state law that governs administrative hearings is the Administrative Procedure Act (APA) (Government Code 11500 et seq.) The APA governs how administrative hearings are to be conducted, discovery rights for the parties, decision-making authority for Administrative Law Judges (ALJ), and noticing requirements. The APA was first promulgated in 1946 in response to the need for a streamlined quasi-judicial[8] process for cases involving claims against government agencies or violations of administrative law. The use of the APA by consumer protection agencies offers an expedited, less expensive way for regulated entities and the government to resolve violations. Most states have something similar to the APA on the books as well. Some BAR cases involving more severe violations are referred to local district attorneys for prosecution through the criminal justice system.

Provisions of the APA have attracted criticism from industry for alleged deprivations of due process protections as guaranteed by the 5th and 14th amendments to the U.S. Constitution.[9] These deprivations include the following four issues:

1. In California, an ALJ makes a proposed decision based on a finding of fact (i.e., what the ALJ decides is the true course of events based on the evidence and testimony presented) and the relevant statutes. Government Code 11517(c)(2)(E) then allows an agency director (i.e., the DCA Director) to:
   - Adopt the decision entirely,
   - Reduce the penalty and adopt,
   - Make minor changes to the decision and adopt it,
   - Reject the decision and remand it back to the ALJ for further fact gathering, or
   - Reject the decision and make another decision based on the record.[10] This is called the non-adopt option.[11]

   About 90% of cases that went to hearing are adopted by the agency as originally proposed by the ALJ with non-adopts comprising about 10%.[12]

   The criticism stems from a concern that the final decision is not made by an ALJ, an ostensibly unbiased person with regard to the case, but rather by the head of a government-run consumer protection agency, someone who will ostensibly have a bias in favor of the consumer rather than the industry.[13] In addition, since the final

[8] Quasi-judicial actions are those not adjudicated by a judge.
[9] The 5th amendment applies only to federal courts but the 14th amendment applies to state courts and agencies.
[10] In the case of BAR non-adopts, the final decision is usually made by a DCA staff attorney.
[11] Not all states have a non-adopt option for a proposed decision. In Washington State for example, the decision of an ALJ is final. In contrast, the federal APA does provide for a similar non-adopt provision in cases not presided over by an employee of the agency bringing an action.
[12] For the last three completed fiscal years, 1047 disciplinary cases were closed out. 21% were default decisions where the licensee didn't contest the charges. 55% were resolved through settlements. Another 244 cases (23%) went through a full hearing. Of these 244 hearing decisions, 218 (89%) were adopted by DCA, 26 (11%) were non-adopts.
[13] It should be mentioned that the APA has an ex-parte communication provision that prohibits the DCA Director from communicating with any BAR employee about the case. This provision cuts both ways. It prevents any case-specific bias from interfering with the Director's decision. It also contributes to the lack of direct knowledge about the case or how the hearing was conducted.

decision maker at DCA, usually an agency attorney, does not attend the hearing and makes a final decision based on the record, the decision is based on second-hand testimony. The decision maker has not had the opportunity to observe the proceedings, witnesses, the demeanor of the respondents, etc.

Enough proposed decisions are non-adopted and then ultimately changed by the DCA Director in favor of harsher sanctions to raise concerns among industry that even if a favorable decision is obtained at a hearing (e.g., probation), the final penalty will end up being harsher (e.g., a 10-day suspension.) In our case audit we found that of 26 non-adopt decisions in our sample, sanctions were ultimately increased by the DCA Director in 17 of them. In three cases the sanction was reduced.[14]

According to private attorneys who handle BAR cases, the existence of the non-adopt provision in GC 11517 is a disincentive to seek a hearing to either disprove the allegations or, more typically, provide enough mitigating circumstances at a hearing to reduce the penalty to something more acceptable to the respondent.[15] A well-functioning judicial system should have as few barriers as possible for the litigants. The concern of industry is that the non-adopt provision and the resulting creation of a biased referee is a deprivation of due process and a barrier to availing themselves of the judicial process that is set out for them.

2. The second key issue are the limited discovery rights that are provided by the APA. GC 11507.5 limits the discovery available to a respondent. A key exclusion is the right to take depositions and interrogatories. These limitations can hamper the defense that can be brought to bear.

3. Third, B&P Code 125.3 allows the State to recover the cost of investigating a case from a respondent if allegations are proven.[16] There is no provision for a respondent to recover the cost of their defense even if none of the allegations are proven. The respondent will always be responsible for the cost of their defense and probably the State's investigatory costs as well. This significantly raises the cost to seek a hearing, limits access to the judicial system for a respondent and increases the probability that a respondent will settle charges rather than challenge them in a hearing.

4. Fourth, the Repair Act allows BAR personnel to conduct unannounced inspections of ARD business records such as repair authorizations, invoices, etc. regardless of probable cause.[17] This provision is unpopular with ARDs who consider the practice to be disruptive, heavy-handed and a violation of the Constitutional protection against unreasonable search and seizure.[18]

[14] About half of the increased sanctions resulted in full revocation. In the three case (actually part of a single case) where sanctions were reduced the amount of cost recovery was reduced.
[15] A respondent is a licensee who is the subject of a formal disciplinary matter.
[16] The average cost to the BAR of investigating a case that is referred to the Attorney General was $9,900 in FY 02/03.
[17] B&P Code section 9884.11
[18] 4th amendment to the U.S. Constitution.

What due process is required?

A related question to "What due process is provided?" is what due process is really required? Should there be a completely unbiased referee? Should a respondent have unlimited ability to present evidence and testimony? Should the BAR have the ability to conduct warrantless record searches? To answer these questions it is necessary to explore legal precedent of due process and how it is applied in this situation.

What due process is required?

A key precedent to answer these questions is Nebbia v. State of New York decided by the U.S. Supreme Court in 1934.[19] Nebbia concerned a regulatory action involving price supports in the dairy industry. A key issue in Nebbia was whether full due process as afforded by the 5th and 14th amendments to the Constitution were required in undertaking a regulatory scheme.[20] According to the majority opinion:

> ". . the guaranty of due process, as has often been held, demands only that the law shall not be unreasonable, arbitrary, or capricious, and that the means selected shall have a real and substantial relation to the object sought to be attained."

In the context of auto repair regulation, this means that full due process is not required in a regulatory scheme if the regulatory means and methods have a direct relation to the objective of the regulatory program.

The decision also addresses the issue whether a regulatory license constitutes a right or a privilege:

> "The Constitution does not guarantee the unrestricted privilege to engage in a business or to conduct it as one pleases. Certain kinds of businesses may be prohibited and the right to conduct a business, or to pursue a calling, may be conditioned. Regulation of a business to prevent waste of the state's resources may be justified."

Again in the context of auto repair regulation, this means that conducting an auto repair or smog check business in California is not an unfettered right but rather a privilege that can be "conditioned" by the state in the interest of enhancing the health and welfare of the state. By making the distinction that a license is a conditional privilege and not a Constitutional right, this also lowers the bar for what due process rights are required in a regulatory scheme.

[19] Nebbia v. People of State of New York, 291 U.S. 502 (1934). Majority opinion delivered by Justice Owen Roberts.
[20] Due process guarantees under the 14th amendment are limited to notice of the charges and the right to a hearing.

Should there be an unbiased referee?

Obviously the referee should be unbiased but does the current system create a biased referee as some in industry contend? Regarding the question of whether the non-adopt provision in GC 11517 results in a biased referee or adjudicator, two legal sources apply:

GC 11425.30(a) states:

> "A person [which includes an agency] may not serve as presiding officer in an adjudicative matter [such as a BAR administrative hearing] in any of the following circumstances: (1) the person has served as investigator, prosecutor, or advocate in the proceeding or its preadjudicative stage. (2) the person is subject to the authority, direction, or discretion of a person who has served as investigator, prosecutor, or advocate in the proceeding or its preadjudicative stage."[21]

This statute applies to DCA as BAR employees, who are ultimately under the direction of DCA, serve as investigators on BAR cases and act as prosecution witnesses in administrative hearings. All DCA staff, including the Director, are assumed to be advocates for consumers based on the agency mission and the business of the agency. This statute is in conflict with GC 11517 as 11517 allows the DCA Director to be the final adjudicator in BAR cases.[22] While this doesn't prove that the referee (i.e., the DCA Director) is biased against a respondent, it does create the potential for bias to influence the outcomes of these cases. Balancing this, the APA does have a provision, GC Section 11430.70, that creates a firewall between the DCA Director and BAR staff and prevents any ex-parte communication regarding a case. GC 11430.70 can mitigate the effect of combining the adjudicative and investigatory functions within one agency. However, the issue of overall agency bias remains.

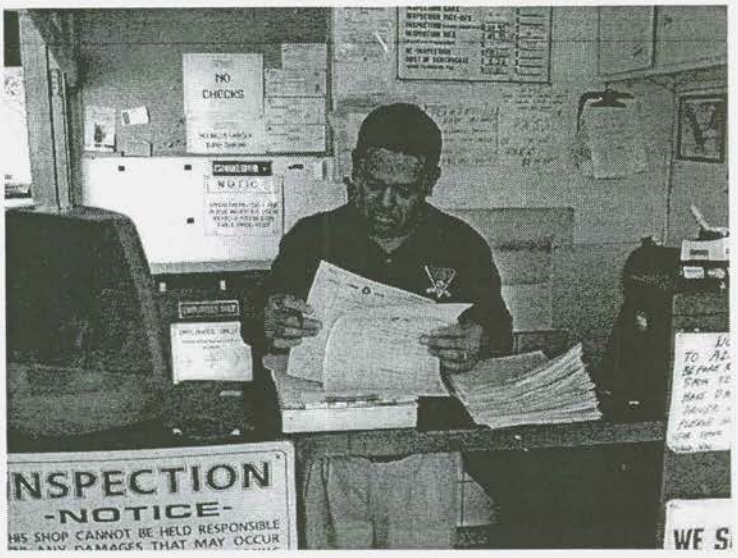
The second source is a 1975 U.S. Supreme Court case, Withrow v. Larkin,[23] that involved a disciplinary action against a physician in Wisconsin. In Withrow, the court ruled that combining investigative and adjudicative functions within an agency does not automatically constitute a violation of due process under the 14th amendment to the U.S. Constitution. The court ruled that agency adjudicators, such as the DCA Director for example, are assumed to be impartial in the absence of evidence to the contrary. This ruling would appear to permit the current system of agency non-adopts.

As seen in the previous paragraphs, there is no clear answer as to what due process is required as it pertains to agency adjudicators and the non-adopt provision. The federal case allows the GC 11517 provision but it does not invalidate the California statute, GC 11425.30(a), that seeks to separate the functions. The federal case serves as a boundary to what constitutes due process. States are free to craft their due process provisions any way they want as long as they don't cross those boundaries.

[21] Phrases in brackets added for clarification.
[22] Since GC 11517 applies to all agencies, bureaus and boards that use the APA the conflict applies to a vast spectrum of government actions in California.
[23] Withrow v. Larkin, 421 U.S. 35 (1975)

Should the BAR have the ability to conduct warrantless record searches?

The unfettered access to business records as provided in the Repair Act has also been tested in the courts. Numerous cases have upheld the government's ability to conduct warrantless searches in the context of a regulatory program. In these cases it has been held that in effect the statute authorizing the regulatory scheme becomes the warrant and that the state could conduct these searches so long as they supported the purposes of the regulatory scheme and the authorizing statute was carefully crafted to establish this relationship.[24]



Inspecting invoices at a smog check station.

To summarize this section, in California regulatory schemes such as the BAR the limited due process provided by the APA is adequate given the regulatory interests of the state in promoting the public's health and welfare and the state's power to condition the ability to conduct a business to achieve the objectives of the regulation. The only requirements upon the state are that the regulation not be unreasonable, arbitrary or capricious and that the regulatory methods have some relation to the regulatory objective.

Is the BAR unreasonable, arbitrary or capricious?

Our investigation included a limited audit of BAR cases, and observations of field staff, office/citation conferences and administrative hearings. Other than one isolated exception our investigation did not uncover any evidence that BAR personnel are unreasonable, arbitrary or capricious. During ridealongs with program representatives in the field, the representatives were unfailingly professional in their demeanor and actions. Similarly, observations of office conferences and citation conferences showed that BAR representatives were definitely firm and meant business but were fair and professional and did not cross the line into being unreasonable, arbitrary or capricious. Obviously these program representatives knew the Enforcement Monitor's role and were doubtlessly careful to project a positive image. However, there was no indication that the behavior observed

[24] See New York v. Burger, 482 U.S. 691(1987) and Donovan v. Dewey, 452 US 594 (1981). The Dewey case established a three-part test to determine if warrantless searches were permissible: 1) Does the state have a substantial interest in regulating a particular industry?, 2) Does the regulation serve that interest?, and 3) Do statutory safeguards provide an adequate substitute for a warrant requirement?

was extraordinary. Furthermore, no specific examples have been related that suggest that the behavior observed is extraordinary.

A limited audit of cases that were resolved either through settlement or administrative hearings showed that cases were well documented and, as discussed in more detail later, resulted in sanctions that were in line with the violations either proven or admitted. In only one case did the sanction seem unreasonable given the proven violations and the aggravating and mitigating factors.[25]

An office conference with a licensee.

One issue observed is the varying levels of clarity regarding documenting office and citation conferences. Citation conferences, associated with the smog check program, are documented with clear, descriptive citation reports. These reports are signed by the licensee with an explanation of the consequences of the conference and what a licensee is guaranteeing or acknowledging by signing the report. In contrast, conference reports used in automotive repair office conferences lack a similar guarantee or acknowledgement associated with a signature. A related issue is the use of the term "confirmed violations" in automotive repair conference reports. Since there has been no hearing or other adjudicative steps, nothing is "confirmed." The report should simply use the term "violations" rather than imply that they are "confirmed." The smog check citation report uses this approach.

Due process with a small "d"

Above and beyond what the Constitution and the APA guarantee as a minimal floor of due process protection is the notion of due process with a small "d". That is, should the state provide for additional due process measures above and beyond the minimal requirement in the interests of economic development, fairness, or implementing checks and balances on the regulatory powers of the government?

Even though the BAR regulatory system passes muster as being constitutionally sound, it is still a system that is stacked against licensees. As mentioned earlier, the uncertainty of the non-adopt provision and the cost of contesting a case in a hearing without the ability to recoup those costs pose substantial hurdles for a licensee that wishes to test the state's case.

Even though almost no examples of unreasonable, arbitrary or capricious conduct were observed the potential exists as shown by the isolated cases. A well-functioning judicial or quasi-judicial system should have safeguards to either prevent or rectify unfair outcomes. In addition to the APA, the BAR system does have some of these safeguards:

[25] Setrakian & Isayan, ARD # AK202057, 2003.

- Licensees who wish to appeal the results of an administrative action can file a writ of mandamus and have their case reviewed by a Superior Court judge in their county. This review is limited to the record from the administrative hearing augmented by briefs prepared by the attorneys representing the state and the licensee. No new testimony or evidence can be presented. The Superior Court judge can reverse or affirm a decision of the ALJ/Department or remand the case for further consideration. Further appeal is to the State Supreme Court. An appeal to Superior Court can cost a licensee additional legal fees above and beyond what was spent in the administrative hearing. In addition, there is no guarantee that the judge will have any relevant knowledge about the BAR, the auto repair or smog check industry or even consumer protection for that matter.

- In 2003 an ombudsman was appointed to be available to licensees that had concerns or questions about mediation, consumer complaints, investigations or disciplinary proceedings. The individual appointed to this position also supervises one of the four mediation centers operated by DCA. The hope was that the ombudsman would be able to address industry concerns about BAR processes and be able to resolve matters that were deemed to be handled unfairly or unprofessionally. However, the authority of the ombudsman is not defined well and it is unclear to many observers, including the ombudsman, how much discretion or power the position has to resolve any matter. Properly structured, the ombudsman position could be an effective way to handle matters involving arbitrary or unreasonable program representatives, problem cases or mediation matters, etc.

The legislature and DCA should consider if it makes sense to implement due process enhancements in the interest of improving fairness and access to a hearing. If these enhancements do not impair the ability of the agency to regulate the industry and take action when warranted they should be implemented.

Recommendations

Recommendation 1 – The Legislature should exclude the non-adopt provision from the Auto Repair Act. The Auto Repair Act section that specifies using the Administrative Procedure Act for a BAR hearing (Section 9884.12) should be amended to exclude Government Code Section 11517. The rest of the APA would still apply.

Recommendation 2 – The BAR should amend office conference reports to include an acknowledgement at the end of the report regarding the attendee's understanding of what was discussed and the purposes of the conference. The conference report text used in smog check citation conferences could serve as a useful guide for this.

Recommendation 3 – The Legislature should amend B&P Code 125.3 directing DCA to pay all actual legal fees incurred by licensees where the BAR was not able to prove a substantial number of the allegations in an administrative hearing.

Recommendation 4 – DCA should enhance the guidelines and authority of the ombudsman. The ombudsman should report directly to the Director of DCA and should not be encumbered with any other duties that would involve another reporting relationship. The ombudsman should have the ability to investigate any report of unreasonable or arbitrary conduct and have access to any documentation regarding an open or closed investigation or

disciplinary matter. The ombudsman should report any unreasonable or arbitrary conduct to either the DCA Director or the Special Operations Unit of DCA.

Chapter 2 - Should the Repair Act include a specific definition of fraud?

How is fraud defined now?

Fraud is defined in the California Civil Code in section 1572 as actual fraud and in section 1573 as constructive fraud.[26] The key distinction between the two being that constructive fraud does not require fraudulent intent. Either case removes the essential element of consent from a contractual relationship and renders a contract void. Auto repair transactions, being a form of a contract are covered under the Civil Code, therefore constructive fraud is applicable to auto repair contracts at least as far as they would be treated in a civil lawsuit. Penal Code sections 8 and 532 also define the scope of fraud for criminal cases. The B&P Code defines fraudulent activity for application in auto repair licensing cases to include the following acts:

1. Any other conduct which constitutes fraud.[27]
2. Making false promises of a character likely to influence, persuade, or induce a customer to authorize the repair, service, or maintenance of automobiles.[28]
3. Making or authorizing in any manner or by any means whatever any statement written or oral which is untrue or misleading, and which is known [to be untrue or misleading][29], or which by the exercise of reasonable care should be known, to be untrue or misleading.[30]

For purposes of sanctioning or restricting an auto repair license, the second and third elements in the list are much easier to prove given that the standard for proving a violation is "false promises . . . likely to influence" or "making . . any statement . . which by the exercise of reasonable care should be known, to be untrue or misleading." In contrast, the first element requires actual intent and injury. Thus the Legislature has imposed a duty on the industry to "exercise reasonable care" in truthfully diagnosing the condition of vehicles presented by consumers rather than simply making any diagnosis and hoping that it is true with no consequences otherwise. In addition, industry has a duty to ensure that they make no false statements that would "likely influence" a consumer to agree to a repair, not just a

[26] Both statutes added in 1872.
[27] B&P Code section 9884.7(a)(4)
[28] B&P Code section 9884.7(a)(8)
[29] Phrase in brackets added for clarification.
[30] B&P Code section 9884.7(a)(1)

false statement that really did influence a consumer to their detriment. By establishing these hurdles it is argued that industry has been held to an unreasonable standard and that making a mistake is now a punishable act.

To distinguish between those licensees that merely make mistakes and those that do not exercise reasonable care in diagnosing auto repairs on a consistent basis, the BAR usually attempts to replicate a particular punishable act through documenting more than one consumer complaint of the same nature or running multiple undercover cars through an ARD to see if the same or similar violation results.[31] Our case audit includes a component to determine whether isolated mistakes are being treated as grounds for sanctioning or whether a licensee has to demonstrate a systemic lack of reasonable care in diagnosing vehicles. Audit results suggest that sanctions have not been applied unless a pattern of violations was observed.[32]

Should the Repair Act have an industry-specific definition?

Industry has suggested that the definition of fraud found in the Auto Repair Act is too broad and, in fact, encompasses acts that may be mere mistakes rather than fraudulent behavior. These suggestions advocate limiting the definition of fraud to just those acts which meet the definition of actual fraud especially the element of intent to deceive. This would exclude any definition that could be read as constructive fraud, which doesn't require the element of intent. By doing this, the reasonable care standard as found in B&P 9884.7(a)(1) would be eliminated and making false and misleading statements would be a punishable violation only if the licensee knew them to be false or misleading. Without the reasonable care standard the BAR would have a much harder task in proving that licensees intentionally made false or misleading statements.

There are two key problems with taking this approach:

1. It can be argued that without the reasonable care standard, consumers may be harmed as licensees could merely guess or speculate about the true source of vehicle problems rather than make a reasonable effort to diagnose a problem correctly as long as they did not attempt to intentionally oversell services and parts. Making an insufficient effort to diagnose vehicles, while detrimental to the business and customer goodwill, would not have any consequences as far as the license is concerned. In addition, by eliminating a reasonable care standard this would run contrary to the fiduciary duty of the licensee to the consumer who relies on the advice of a professional technician to diagnose a problem and make repairs where most consumers are ill-equipped to question the professional.[33] This appears to conflict with the intent of the Automotive Repair Act which is to protect the public.

[31] Replicating a violation is standard practice in consumer protection schemes where fraud needs to be proven in order to make a distinction between systemically fraudulent behavior and simple mistakes. In weights and measures enforcement for example, inspectors will test the accuracy of retail scanning devices by making several test purchases at multiple locations to prove that fraudulently mis-pricing merchandise is a systemic problem, whether intentional or not.

[32] See Chapter 4 for more detail.

[33] See Estate of Gump (1991) 1 Cal.App.4th 582 for a discussion of the fiduciary relationship and its bearing on constructive fraud.

2. The second key problem is that other areas of California law do not exclude a reasonable care standard in making statements forming the basis of a contract. As mentioned earlier, Civil Code section 1573 - Constructive Fraud, specifically includes as a basis for voiding a contract the act of misleading another party to their detriment even if the element of fraudulent intent was absent. It seems clear that the Legislature intended that the conduct of business in California was to be based on a higher standard than being able to unwittingly make false statements in the course of a transaction without consequences or a minimal requirement to determine the truthfulness of those statements. This seems especially true in a fiduciary relationship such as that exists between a presumably trained professional mechanic and the average motorist. It would seem hypocritical to have two standards to judge the same behavior: one for judging the validity of private contracts and another, lighter standard for judging a licensee's fitness to hold that license.

Based on these two key points, it seems clear that the intent of the Act and the interest of the state government in enhancing the public welfare would argue for preserving the existing definition of fraud in the B&P Code.

Is there a more helpful description of what conduct constitutes fraud in an auto repair context?

One of the real issues with the way fraud is defined in the B&P Code is not that the definition is too broad but rather that it is difficult to understand and apply in a real-world business setting on a daily basis. Any layperson reading either the fraud definitions in the B&P or Civil code would be perplexed. As mentioned earlier, the BAR tries to distinguish between isolated mistakes in diagnosing and selling auto repairs and systemically fraudulent activity. It may benefit industry to hear how that line is crossed explained in plain English rather than in legalese.

Recommendations

Recommendation 5 – The Legislature and/or the BAR should provide more clarity to the notion of constructive fraud. This can be accomplished in a couple of ways:

- The actual statute, especially B&P Code 9884.7(a)(1) and 9884.7(a)(8) can be amended to include specific examples of what behavior is a violation with a qualifier that the examples are not exhaustive or all-encompassing;

  And/or

- BAR educational materials such as the Write-it-Right series of publications could be expanded to include sections on what fraud is (both types), what "reasonable care" entails, real-world examples of how ARDs get into trouble with the fraud statutes, simple steps and safeguards for running a business, operating work order systems, etc. while avoiding committing fraud violations. This can also be accomplished in a program of basic licensee training (See Recommendation 8 on page 37 for more details)

Chapter 3 - Are regulators enforcing documentation and paperwork standards that don't exist?

Another way to ask the question is:

Does the BAR enforce standards that are divorced from the original intent of the Act?

The original Automotive Repair Act was passed in 1972. Like many laws, in the last 33 years the Act has evolved to better address contemporary industry conditions and public policy considerations. Using the original intent of the Repair Act as a target for comparing how today's program is operated and how discipline is meted out lacks relevance. It should also be noted that many of the Act's provisions that are characterized as being out of touch or minutiae have been in the Act since the beginning. For example, statutes requiring a licensee to provide a written estimate, consent of the customer for additional work, full disclosure on an invoice were all included in the original legislation. Paperwork standards and the seemingly persnickety rules for how estimates and invoices are written up and submitted seem to be at the heart of some discomfort among industry.

Discussing documentation standards with a BAR ARD registrant.

The current, and original intent of these statutes was to standardize and clarify how auto repair diagnoses are communicated to consumers to eliminate misunderstandings that could potentially turn into complaints, demands for rework, refunds, small claims filings, etc. The intent of the statutes is also to bring the entire industry up to an acceptable standard of professional conduct.

A bigger issue may be the inability of auto repair/smog check systems to generate estimates, work orders and invoices in a way that is compliant with the Repair Act. It

Chapter 4 - Is the system of sanctions commensurate with the degree of violation?

We conducted a limited, non-statistical audit of resolved BAR disciplinary actions to help answer three questions:

1. Do non-adopt decisions result in greater sanctions?
2. Do cases get resolved with greater sanctions than the guidelines allow?
3. Do cases get resolved with greater sanctions than the facts would warrant?

The case audit sample had the following characteristics:

- 17 total cases

- 3 cases were resolved through stipulated settlements
- 14 cases were resolved after an administrative hearing

- 7 cases were selected by the BAR[34]
- 5 cases were selected at random by the Enforcement Monitor
- 5 cases were referred by industry

- 10 cases were for auto repair dealers
- 7 cases were for smog check stations

- 5 cases were non-adopt decisions

An additional 21 non-adopt cases were examined in less depth to determine the impact of non-adopt decisions on sanctions that were ultimately applied.

Do non-adopt decisions result in greater sanctions?

Non-adopt decisions refer to a feature of the Administrative Procedure Act (Section 11517(c)(2)(E) that allows an agency to "reject the proposed decision [of the Administrative Law Judge], and decide the case upon the record."[35] The provision is used occasionally by the Director of DCA or their designee to change the proposed sanction. As discussed in Chapter 1 this feature has the appearance of depriving the respondent of an unbiased

[34] BAR was asked to select some cases for the sample because we wanted to review recent non-adopt cases. BAR staff were in a position to identify these cases.
[35] Phrase in brackets added for clarification.

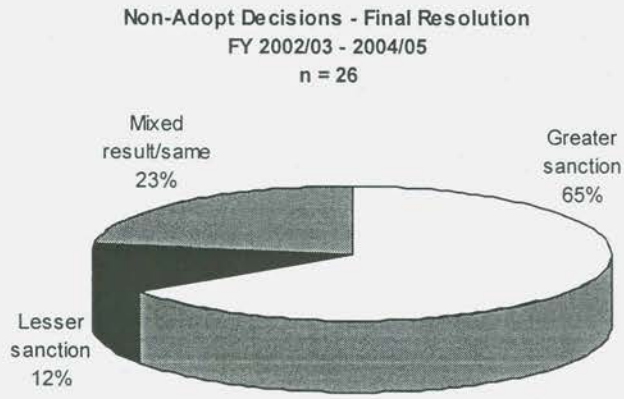
referee in the case since the ultimate decision is made by an individual with an ostensible bias toward the consumer as the head of a consumer protection agency. In addition, the ultimate decision maker does not even attend the hearing and instead relies solely on the record. This feature is criticized by industry as a disincentive to seeking a hearing.

In our audit, we sought to determine whether there was any practical impact from Section 11517. We examined the proposed and final decisions for cases where the ALJ's proposed decision was not adopted by DCA for a 3-year period. The results were categorized as follows:

- Final decisions where the ultimate sanction was greater than that proposed,
- Final decisions where the ultimate sanction was lesser than that proposed, and
- Final decisions where the ultimate sanction was the same as that proposed.

The following chart shows the results of our audit:

Figure 3 – Non-adopt decisions – final resolution



As seen in the chart, 17 of 26 (65%) final decisions resulted in a greater sanction than that proposed by the ALJ.[36] A typical "Decision after non-adoption" may add a 5 or 10-day suspension if the ALJ was just proposing probation. This chart lends credence to industry concerns that seeking a hearing may not be a good strategy as the decision of the ALJ cannot be relied upon as the final resolution. In fact, there is about a ten percent chance that a final decision may be rendered by DCA after non-adopting the ALJ's decision and of those, most are unfavorable to the respondent.

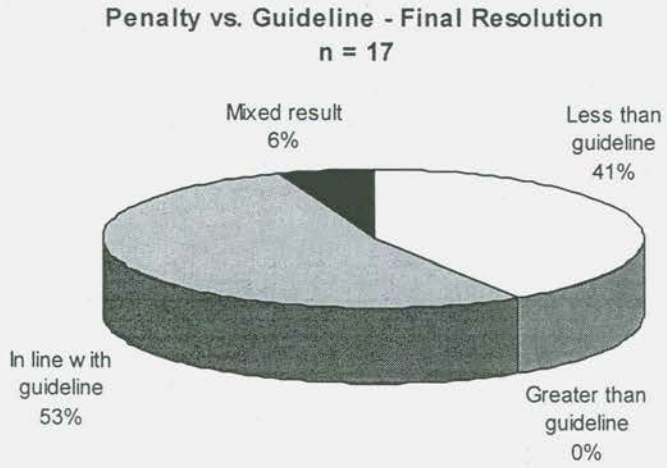
[36] Only about 10% of all cases heard in an administrative hearing are non-adopted. The other 90% are adopted as proposed by the ALJ. Also, 77% of all cases never make it to a hearing and either settle or the charges are not contested and result in a default decision.

Do cases get resolved with greater sanctions than the guidelines allow?

The BAR has prepared Guidelines for Disciplinary Penalties and Terms of Probation[37] that establishes a range of sanctions for common violations of the Repair Act and the Health & Safety Code. For example, the range of sanctions for violating B&P Code 9884.7(a)(1), making false and misleading statements, would be revocation on the high end and a 10-day suspension[38] plus 2 years of probation on the low end. Like most sentencing guidelines used in judicial environments, the disciplinary guidelines are intended to instill consistency in how sanctions are applied so that there is a greater nexus between violations and penalties.

To ensure that cases are not being resolved with greater or lesser sanctions than called for in the guidelines we compared final decisions with the published guidelines in our audit.[39] The following chart shows our results:

Figure 4 – Penalty vs. guidelines – final resolution



As seen in the chart, 53% of cases in our sample were decided within the guidelines. The chart also shows that cases are frequently decided with a sanction that is less than the guidelines. In fact, of the five non-adopt decisions in our sample, two were ultimately decided with sanctions less than the guidelines which shows that under-sanctioning is not just within the realm of ALJs. The audit also showed that no cases were decided at a sanction that was more than the guidelines although the highest sanction for most violations is revocation so it would be hard to exceed this sanction.

[37] Published September 2003.
[38] The guidelines actually call for a 90-day suspension with 80 days stayed or reduced.
[39] Final decisions incorporate those decisions made after a non-adopt.

Do cases get resolved with greater sanctions than the facts would warrant?

The third part of the bigger question of whether sanctions are commensurate with the degree of violation is whether cases get resolved with greater sanctions than the facts would warrant. This question addresses an industry concern that relatively minor offenses are heavily sanctioned. This is a much trickier question to answer as there are frequently mitigating and aggravating circumstances that can complicate the question of whether a licensee deserves a particular sanction. Typical mitigating factors are:

- Respondent had no prior disciplinary record or record of problems,
- Respondent terminated the employees committing the violation as soon as it was brought to their attention,[40]
- Respondent fully cooperated with the investigation and showed remorse, and
- Respondent refunded consumers who had complained or been financially injured.

Typical aggravating circumstances include:

- A history of disciplinary problems, citations or prior violations,
- Respondent was not cooperative or demonstrated a negative attitude,[41] and
- Respondent made no effort to rectify the practice in question.

Also complicating this is the degree of the violation. A smog check practice that violates the Health & Safety Code may be a misunderstanding of the rules. In other cases, smog check stations may be out-and-out cheating the system by clean piping cars.[42] A first-time clean piping violation will usually result in full revocation while a first-time offender who is simply performing the wrong test may get a lesser sanction. The BAR has a policy of revoking licensees who commit the most egregious violations no matter what their disciplinary history.[43]

Our case audit showed that almost all allegations in BAR cases were found to be factual in the course of a hearing.[44] This determination was made by comparing the allegations in an accusation to those listed in the Findings of Fact section of a decision. If the ALJ felt the allegations were true they would be included in the Finding of Fact. This high rate is attributable to the extensive investigation that typically occurs in a disciplinary case. Another factor could be the limited defense that a licensee can employ as discussed in Chapter 1, a factor that makes the system slightly stacked in favor of the State.

[40] Although terminating the offending employee is not identified as a factor in BAR disciplinary guidelines, it is mentioned in ALJ decisions.
[41] Ibid.
[42] Clean piping involves testing a clean-running vehicle and using the test results to certify another vehicle that would not pass on its own. The practice is deemed to be a serious violation of the Health & Safety Code.
[43] This policy is based on B&P Code 9880.3 where protection of the public is the paramount goal of the program. If a licensee is deemed to be a threat to the public by committing egregiously fraudulent acts or clean piping cars the agency will err on the side of harsher sanctions.
[44] Finding allegations to be factual is analogous to proving them.

Besides the question of whether the system is stacked in one direction or another, our audit also made a judgment as to whether the sanctions applied in a case seemed appropriate given the sanctions ordered in similar cases and based on the relative severity of the violation. We found that:

- Serious sanctions such as revocation and long suspensions were exclusively reserved for the most serious violations such as fraud, clean piping cars, repeat offenders or cases with multiple aggravating circumstances.

- In most cases sanctions seemed to be consistently applied and generally in line with the severity of the offense. In one exception, a smog check business was fully revoked for conducting the incorrect tests on vehicles in spite of multiple mitigating circumstances.[45] In similar cases, this would have resulted in probation with a short suspension.

We intend to continue sampling cases to further examine this question.

Conclusions

Due to the effect of the non-adopt provision in the APA, some cases are sanctioned at a greater level than what is proposed in administrative hearing. This lends credence to the concern of industry that a hearing ultimately may not result in an unbiased decision. In addition, while the majority of cases are decided within (or even less than) established disciplinary guidelines, it is not unknown for sanctions to exceed what the facts and precedent would suggest is fair.

These conclusions lend support to the notion that the disciplinary system, while it passes constitutional muster regarding due process, is slightly stacked in favor of the State. Simple measures to improve fairness, if they can be implemented without degrading the enforcement powers of the agency, are warranted.

Recommendations

Recommendation – The Legislature should exclude the non-adopt provision from the Auto Repair Act. See recommendation 1 on page 18 for more details.

[45] In this case, Setrakian, the licensees had no prior disciplinary history and had started implementing corrective actions after the disciplinary process started. A proposed decision ordered probation. A non-adopt was filed by DCA with the non-adopt decision ordering full revocation.

Chapter 5 - Should the BAR be in the business of setting and enforcing trade standards?

How are trade standards codified?

The Auto Repair Act and the Health & Safety Code define trade standards a couple of different ways:

- B&P Code 9884.7(a)(7) gives the BAR the ability to invalidate or restrict an auto repair dealer (ARD) registration for "Any willful departure from or disregard of accepted trade standards for good and workmanlike repair in any material respect . . . " The statute does not make a reference to what trade standards could be departed from or disregarded.
- Title 16 of the California Code of Regulations (CCR) specifies trade standards for various auto repairs such as ball joints, air conditioning, automatic transmissions and ignition interlock devices. For the most part, these trade standards mostly regulate how the condition of vehicles is diagnosed, documented and communicated to the customer. Only in a couple of cases do the regulations actually specify how a repair is to be made. For example, Section 3365 of Title 16 specifies that corrosion protect should be applied in accordance with manufacturer's specifications.
- Health & Safety Code 44016 and Section 3340.41 of Title 16 CCR specify that smog checks and emission control equipment repairs should be performed according to "industry-standard reference manuals and periodicals" or the "vehicle manufacturer's recommended procedures"

Checking emission testing equipment.

As seen, California law is mostly silent on standards for how vehicle problems should be diagnosed and repaired. Wide discretion is give to ARDs and smog check businesses on how motor vehicles are to be diagnosed and repaired.

In fact, B&P Code 9884.7(a)(7) is rarely used on its own as the basis for a disciplinary action. In our case audit it was not used on its own in any case. 9884.7(a)(7) is a frequently cited violation but it is usually combined with other subsections of 9884.7(a) such as false or misleading statements or fraud. A typical example would be where an ARD allegedly oversells brake repair work such as wheel cylinder or caliper replacement where only a pad/shoe replacement was needed. In this case, 9884.7(a)(1)-[false and misleading statements], would be cited because the ARD diagnosed and/or stated problems with the wheel cylinders or calipers that did not exist. B&P 9884.7(a)(4)-[fraud] would be cited because the consumer relied on the false statement and was economically injured (i.e., they paid for the unnecessary work). B&P 9884.7(a)(7)-[willful departure from trade standards] could be cited because an accepted standard would be to not replace wheel cylinders or calipers unless they were not operating correctly (e.g., leaking brake fluid). Some technicians, however, insist that brake calipers should be replaced more frequently than traditionally called for. As seen in this example, much of the case comes down to a judgment call whether the additional brake repair was needed or not. Regarding trade standards, the statutes or regulations make no mention of when wheel cylinders or calipers should be replaced.[46] If the standards are not defined in statute then the baseline used for comparison becomes one of opinion rather than fact.

Trade standards also become relevant when cars are documented for undercover operations. As mentioned earlier in the report, cars are prepared with an induced operating problem or the condition of a component is checked against some standard such as manufacturer specifications. The technician preparing the vehicle for an undercover operation will prepare a statement citing the condition of the vehicle for use in a disciplinary action if needed. The statement will often reference that a component or part was verified to be within trade standards such as factory specifications (e.g., the thickness of a brake rotor). If an ARD then states that the component is not operating correctly or needs repair it may become an alleged departure from trade standards.

In these two ways trade standards become relevant for purposes of taking disciplinary actions against licensees.

Should the BAR set or adopt trade standards?

It is tempting to define the standard in statute using manufacturer specifications, repair guidelines or published standards such as those from the Mitchell Repair Information Company (Mitchell) that compile standards from various manufacturers into one reference library. In this way, ARDs could diagnose problems and make repairs using an established and accepted baseline for making these judgments.

On the other hand, defining a standard in statute or referring to an existing standard in statute could remove the ability of ARDs to make discretionary decisions about vehicle repairs as they would be legally bound to diagnoses and repairs strictly according to the defined standards. Any departure from this would constitute a departure from standards and would subject the ARD to discipline even if the diagnosis and repair resulted in a

[46] Many ARDs prefer to replace calipers along with brake pads if the vehicle has high mileage because of a belief that the caliper pistons will not work evenly and consistently, especially in heavier vehicles. This example was used because there seems to be a variety of opinions among repair professionals about the need for this type of work.

perfectly good outcome for the consumer. A strict definition could conceivably greatly expand the number of violations and disciplinary actions. Finally, this would obligate the BAR to look into many more cases where the issue was simply workmanship, something the BAR usually limits to mediation except where safety is concerned or the issue is combined with fraud, misleading statements, etc.

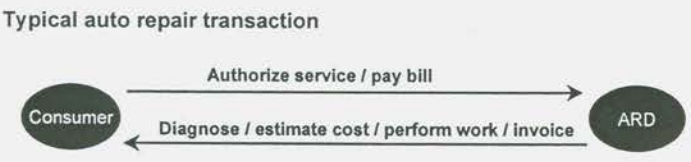
A concern of industry is that if trade standards are not defined in statute then ARDs are being held to an undefined standard when diagnosing and repairing vehicles. Honest mistakes or differences of professional judgment can get caught up in the same net as truly fraudulent behavior. The key seems to be finding a way to separate these two classes of conduct rather than establishing a defined standard in the statute that would completely eliminate any discretion on the part of ARDs. Separating these two classes should be the task of investigators so that only cases involving fraud (including constructive fraud as discussed in Chapter 2) should be disciplined. Should an error be made at this stage and a case involving an honest mistake or a difference in professional judgment reach the stage of an administrative hearing, then an ALJ should be able to make this distinction and reflect it in the findings. A significant flaw with this safeguard is that most ALJs do not specialize in a particular area of government operations. This makes it difficult for ALJs to develop the expertise in auto repair matters to be able to separate the trade standard violations from the differences in professional judgment. A panel of ALJs dedicated to BAR cases would help to improve this safeguard.

Collision repair standards

State law is similarly largely silent regarding trade standards for collision repair. By exception, a small reference is made in CCR 3365 about following manufacturers standards for sectioning body components and applying corrosion resistant material.

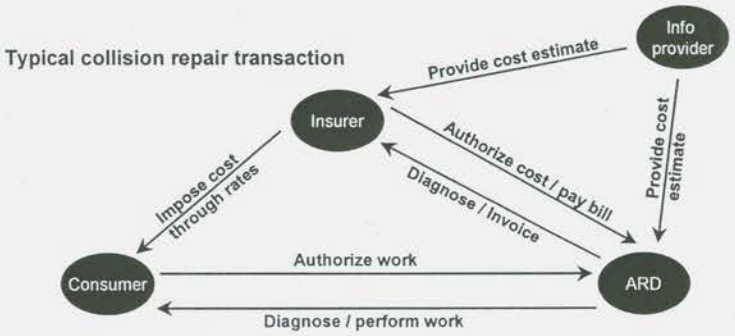
The most significant standards used in collision repair are the parts and labor estimating guidelines provided by "information providers" such as Automatic Data Processing Corp. (ADP) or Mitchell. These estimating guides are used by auto insurers to provide some predictability to the costs of collision repair. This in turn reduces underwriting risk. This results in a system of fixed price contracts for collision repair that most collision repair dealers must abide by.[47] The consumer, relying on the coverage provided by the insurer to pay for the repair, also is de-facto bound by the estimate and bill of material. This system transfers much of the decision making power from the consumer to the insurer and the information provider. The following graphics illustrates this:

Figure 5 – Typical auto repair transaction


Typical auto repair transaction
Authorize service / pay bill
Consumer
ARD
Diagnose / estimate cost / perform work / invoice

[47] Labor hour estimating guides also exist for general auto repair but are not as influential as those used in collision repair.

Figure 6 – Typical collision repair transaction



This graphic shows plainly the flip side to having defined standards. In this case the standards are defined by the information providers and they eliminate much of the discretionary decision making on the part of the consumer and the ARD. The defined standards also create perverse incentives that foment a significant amount of insurance fraud that harms consumers, rate payers and insurers and the reputation of the collision repair industry.

The BAR conducted a study of the collision repair industry in 2003[48] that came to much of the same conclusion. The report noted "the lack of statutory or regulatory requirements informing the working relationship between auto repair facilities and insurance carriers."

Should the BAR adopt a code of ethics?

The language of SB 1542 requested that the Enforcement Monitor determine whether a formal code of ethics should be developed for the auto repair industry in California. In our research, we found an existing code of ethics developed by the Automotive Service Center Program.[49] The code has 13 points that program participants are to adhere to. These 13 points fall into three categories for purposes of this project:

Six of the 13 points are already codified in the Auto Repair Act in some form:

- "Recommend and explain the correct service to repair the customer's car." The inverse to this is a violation of B&P Code 9884.7(a).
- "Provide the customer with a written price estimate before work is performed." This is covered by B&P Code 9884.9.
- "Have the customer authorize all work before it is performed." This is also covered by B&P Code 9884.9.
- "Provide an itemized invoice for all customers." This is covered by B&P Code 9884.8.

[48] Auto Body Repair Inspection Pilot Program, Report to the Legislature, September 2003

[49] We could not find any current reference to the Automotive Service Center Program. It is believed that the program is no longer in operation. The Automotive Service Councils of California (ASCCA) has a 10-point code of ethics which covers much of the same ground as the 13-point code discussed in the text. The ASCCA code includes one unique point: a promise "to refrain from advertisement which is false or misleading and likely to confuse or deceive the customer." This point is covered in the Repair Act as B&P Code sections 9884.7(a)(1) and 9884.7(a)(8). Interestingly, the "likely to confuse or deceive the customer" phrase goes beyond the statutory definition of fraud which requires that the deception actually occur.

- "Return all replaced parts for the customer's inspection unless they are held as a core." This is covered by B&P Code 9884.10.
- "Provide warranty information on both parts and service." This is covered by CCR Section 3376.

The next three points, which emphasize high quality, exceed the standards set by the Auto Repair Act which simply require that ARDs deliver "good and workmanlike" repairs as determined by "accepted trade standards." As mentioned earlier, specifying a specific trade standard would greatly expand the scope of the BAR and would eliminate the discretion of the ARD. Some consumers may not want to pay for the highest quality parts and repairs.

- "Perform the highest quality repair work possible."
- "Use only high quality replacement parts."
- "Employ the most highly skilled automotive technicians."

Other points would be difficult to enforce or fall outside the scope of the Auto Repair Act:

- "Recognize the individual automotive needs of each of my customers." This sounds nice but how would the BAR enforce it?
- "Schedule work by pre-arranged appointment." Same point on this one.

The following two points could be incorporated into statute:

- "Remind the customer of recommended preventive maintenance." This could be within the BAR's purview. However, like specifying trade standards, it would greatly expand the scope of the BAR's enforcement and would be heavily open to interpretation.
- "Notify customers if work will not be completed as promised." This one point seems appropriate for the BAR but it would have to be defined more tightly.

With the possible exception of the last bullet, adopting a code of ethics is either already instilled in much of the Repair Act and regulations or it is unenforceable.

Recommendations

Recommendation 6 – The Office of Administrative Hearings should establish a dedicated panel of judges for BAR cases. This will create a panel of judges more familiar with auto repair cases, standards and issues and result in better decisions. This panel will also be able to identify and address true trade standard cases. A model for how this can be implemented is the dedicated panel that has been established for medical quality cases.

Recommendation 7 - Implement recommendations from the Auto Body Repair Inspection Pilot Program Report to the Legislature. These recommendations include:

1. Consider requiring that those who have the mechanical and/or collision background and equipment to properly evaluate the true condition of the vehicle do the formal estimating of collision damage.
2. Documents produced by insurance adjusters should be identified and explained as a "visual damage assessment."

Chapter 6 - Is the BAR doing enough to prevent violations other than applying sanctions?

What other tools are available?

There are several tools available to the BAR that may improve program outcomes. One option would be to utilize the role of the marketplace to regulate ARDs and smog check stations. Other consumer protection agencies do this through providing a forum where the disciplinary history of regulated businesses is available to consumers. Consumers would then presumably take their business to those without disciplinary problems. The BAR operated a forum like this by listing complaints on a website. The unfortunate, unintended consequences of this website are well known.

Another strategy would be to better educate licensees so that regulatory problems are prevented from happening in the first place. The BAR currently conducts educational seminars for licensees on a voluntary basis. In FY2002/03 BAR staff conducted 670 educational sessions. BAR staff also provide counseling and education sessions for individual licensees on request, during the follow-up for complaints, and during smog check station inspections. The limitations of this strategy were apparent during this project when field observations showed that some licensees and service writers were unaware or ambivalent about some of the more common compliance problems such as giving a customer a copy of an estimate. Doubtlessly for some of these licensees it has never presented a problem but such practices are often at the root of consumer displeasure later in the transaction.

The BAR could also revisit who or what is actually being licensed and disciplined. One issue is that the Repair Act provides that an ARD registration can be issued to a business, not a person.[50] In some cases, when a violation occurs it is the business entity that is disciplined

[50] B&P Code 9880.1 defines an ARD as a "person" but the section goes on to define a person as including a partnership, association, limited liability company or a corporation. There is no requirement to license an actual human being either as a managing employee or an owner. In contrast, Health & Safety Code 44014, which governs the smog check industry, licenses an actual facility and the technicians that work there.

and not the actual human beings that committed the violation or benefited financially. In the smog check program, by contrast, the smog check technician is also licensed and is susceptible to discipline along with the smog check business entity.[51] In the auto repair field, when a registration is invalidated (i.e., revoked), sometimes only the business entity is shut down. The perpetrators and beneficiaries can, and often do, work elsewhere. Even when an individual is subsequently denied a license because of involvement in prior disciplinary actions (a common scenario) they are free to work as employees for another ARD. This frequently results in "fronting" schemes where an individual who has had a license or registration revoked buys or starts another auto repair business in someone else's name, such as a relative. In the end, the net protection afforded to the public is zero.

Discussing a consumer complaint with a service manager at a larger dealership.

A related issue is that many of the problems enforced by the BAR occur at the front counter of an ARD and not the service bay. The employee that communicates with the consumer, prepares the estimate, obtains the work authorization, prepares follow-up estimates, and invoices the work is the primary perpetrator in most violations. In a small business, this person may also be the owner and technician but in larger businesses service writers are the source of many violations. As mentioned in the previous paragraph, these individuals are unlicensed and are therefore not subject to discipline. As with the fronting problems, service writers that commit violations can simply work elsewhere in the same capacity if a license is revoked or invalidated with the resulting net protection to the public amounting to zero.

Those who benefit financially from misconduct are usually not in the service bay either. They can be owner/operators, shareholders of large dealerships or service writers that receive commissions based on the amount of work sold. Again, often these individuals are unlicensed and not subject to discipline.

The current licensing model misses an opportunity to license two key individuals:

1. The actual beneficial owners of an ARD or smog check station. In many cases the business entity is subject to discipline but the beneficial owner walks away.[52,53]
2. Employees that prepare estimates, work orders and invoices, called service writers for convenience. Again, when a business entity is subjected to discipline, the service writer walks away.[54]

[51] Smog check stations must have two licenses: one for being a smog check station and another for being an ARD. Both licenses can be issued to a business entity.
[52] The Enforcement Monitor actually observed this situation in an administrative hearing.
[53] An exception to this is when the individual is prosecuted under the criminal system as sometimes happens.

Recommendations

Recommendation 8 – Establish a system to teach and test for minimal proficiencies. Passing the test should be a condition for obtaining a BAR license. The BAR should augment their current education programs and licensing system to do the following:

- All ARD employees who prepare estimates, work orders, follow-up estimates and invoices (called service writers) should be required to attend an 8-hour course and pass a test as a condition for receiving a license. Existing licensees should also take the course and pass a test within a staggered three-year period. The course would cover:
    - Documentation requirements as found in the Write-it-Right series of publications,
    - The BAR disciplinary system,
    - Sources of information that would help licensees comply with state law,
    - Basic legal information about fraud and constructive fraud and how to prevent it,
    - Other responsibilities of holding a BAR license.
- All service writers should be required to hold a BAR license. This license would be subject to discipline including revocation in the same manner as current ARD registrations and smog check licenses.
- At least one individual who has a financial stake in an ARD or smog check business and any managing employee who has a financial stake should be required to also hold a BAR license. This license would be subject to discipline including revocation in the same manner as current ARD registrations and smog check licenses.
- When violations occur, the BAR would be able to target disciplinary efforts at responsible individuals as well as at business entities. This allows the BAR to do selective targeting of disciplinary efforts. This can be important in a large ARD such as a dealership. For example, rather than be faced with the dilemma of revoking the license of a large dealership and making all the employees unemployed,[55] the BAR could suspend or revoke the license of a service writer, fine the beneficial owner, and put the business license on probation. In other cases where misconduct is a business-wide strategy, all the licenses can be sanctioned.

The benefits to the approach include:

- By requiring this minimal level of training about state standards, it will help ensure a minimal level of proficiency without costing industry much down time,
- Individual licensees, such as service writers, will be much more aware of what the standards are, how they can be complied with, the business benefits of compliance, and how the BAR operates,
- These individual licensees will have a greater incentive to adhere to the Auto Repair Act and Health & Safety Code because they will be personally accountable,

[54] Ibid.

[55] A step that would be fought vociferously and result in many innocent employees being punished.

- The BAR can more accurately target sanctions to the responsible parties. As mentioned earlier, this can be a real advantage when addressing a large ARD like a dealership, and
- Those that financially benefit from violations can be disciplined with more consistency than is currently the case.

Chapter 7 - Areas for further study

The Enforcement Monitor suggests that the following areas be studied in subsequent reports during 2006:

- **Arbitration programs**. The Contractors State License Board operates both mandatory and voluntary binding arbitration programs. These programs are a step up from straight mediation but they clear many disputes over workmanship that would otherwise not get resolved at all or end up in small claims court. We have conducted some research into these programs and suggest that further inquiry be made to see if they would benefit the auto repair industry and its customers.

- **Refine explanation of fraud**. We suggest further refinement of fraud explanations as discussed in recommendation 5. This can be accomplished with BAR staff, DCA staff attorneys and members of the defense bar.

- **System Certification**. As discussed in Chapter 3, the functionality of estimating and invoicing systems may not be able to facilitate compliance with the Repair Act. One potential solution would be for BAR to research and certify estimating and invoicing systems for compliance with state law.

- **Expand case audit**. We suggest further auditing BAR cases (both adjudicated and settled) to further test the findings in this report and enhance our final recommendations. One area to investigate is looking at inducements used in undercover cars to determine the link between the inducement used and the nature of the investigation or complaint.

- **Conduct additional ridealongs**. We suggest additional observations in the field to further enhance our findings and final recommendations.

- **Investigate trade standards for brake diagnosis**. Even though it appears infeasible to adopt wide-ranging trade standards, standards for diagnosing and communicating brake repairs may prevent an area of frequent mis-communication and overselling.

- **Review and evaluate certain administrative aspects of DCA and BAR including**:
    - How program reps are trained (both initial and ongoing CE);
    - Review policies for rejecting proposed ALJ decisions;
    - Evaluate whether BAR adheres to strict charging deadlines;
    - Evaluate efforts and resources dedicated to investigating and enforcing against unlicensed operators; and
    - Revisit minimum penalty guidelines for paperwork violations.

Title

Year Two Report
Bureau of Automotive Repair
Enforcement Monitor

Presented to

Department of Consumer Affairs and
Joint Committee on Boards, Commissions and
Consumer Protection

date

June 9, 2006

BAR
Bureau of Automotive Repair
DRIVE SMART CALIFORNIA

Management Auditing
Process improvement
Strategic planning
Performance measurement
Financial analysis
Organizational design

STRATEGICA INC.

Attachment H

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EXECUTIVE SUMMARY

This Year Two Report follows up on the Enforcement Monitor Year One Report issued on December 20, 2005. This report contains findings and recommendations on several areas of inquiry that emerged since the Year One report was prepared. This document also reports on the implementation status of Year One recommendations.

Shop Management Systems

A key factor in achieving compliance with the Automotive Repair Act[1] and the Health & Safety Code is the quality of the shop management computer systems used by ARDs and smog check stations. The Enforcement Monitor noted that these systems are not always programmed or installed correctly causing many inadvertent violations of the Act. Conversely, a well functioning system can not only benefit the consumer by improving the quality of the transaction but can reduce risk for the shop owner.

The BAR does not have a proactive process or program for working with shop management software providers to improve the functionality of their systems. Software providers we spoke to were supportive of some kind of proactive collaboration with the BAR so they could produce better system specifications and functions for their customers. While this collaboration could be very useful and beneficial for the BAR, software providers, consumers and the repair industry it could not take the form of any guarantee that the software or the documents produced by the software automatically result in compliance. The BAR should implement a program of annual or semi-annual technical conferences for shop management software providers focusing on improving the software and compliance. In addition, the BAR should offer and provide technical reviews of software products on request.

Brake Diagnosis Standards

A frequent source of complaints, violations and fraud involve brake diagnosis and repair. Interview feedback suggests that standards for diagnosing brake problems and communicating these problems to consumers would be helpful by instilling a higher level of objectivity and specificity in brake problem diagnoses and giving consumers a more informed basis for making repair decisions. The BAR should convene a committee of regulators, consumer advocates and industry representatives to explore the feasibility of brake diagnosis standards. A model for this regulation is found in the Findings and Recommendations section of this report.

[1] Business & Professions Code Section 9880 et seq.

Limitations

State law contains statutes (B&P 9889.8 and H&S 44072.7) setting time limits for filing accusations against brake and lamp stations and smog check stations. Except for cases of fraud, these statutes set a limit of three years between the date of a violation and the date an accusation is filed.[2] There has been a general presumption that B&P 9889.8 applied to all ARD disciplinary cases. However, a careful reading of the statute will reveal that the statute only applies to brake and lamp stations. The result is that, in fact, there is no limitation that applies to other ARDs. The Legislature should amend the B&P Code to include limitations for consumer protection cases filed under B&P Section 9884 modeled after the existing limitation statutes.

Minimal Penalty Guidelines

Title 16 of the CCR contains penalty guidelines for violations of key provisions in the B&P and H&S Codes. In some cases there is a wide disparity in these guidelines between provisions addressing smog check violations and auto repair violations. These encompass violations addressing preparation of estimates and invoices. Fortunately, the BAR has prepared and submitted a Regulation Change Proposal dated 12/28/05 that clears up these disparities along with some additional clarifications in the guidelines. We recommend the State adopt this Regulation Change Proposal.

Additional Areas of Investigation

Arbitration – Binding arbitration (mandatory and/or voluntary) was investigated for its potential in resolving some portion of the consumer complaint workload. Unfortunately, the potential cost of arbitration and the BAR's prior experience with the technique do not favor its successful implementation and we are not recommending its adoption.

Program Rep Training – The Enforcement Monitor reviewed the scope of program representative training programs and attendance data. The programs were found to be broad in scope covering a range of technical and policy subjects and were well attended.

Charging Timelines – An analysis of actual timeliness data for investigating and charging BAR disciplinary cases show that, on average, cases are charged within statutory deadlines. The average case is filed within 348 days[3] and decisions are reached within 797 days.[4] In addition to charging disciplinary cases, the BAR mediates complaints in 35 days on average.

Unlicensed Activity – The BAR dedicates 12 staffpersons to the problem of unlicensed auto repair businesses (most "unlicensed" businesses are just delinquent in renewing). These staffpersons utilize a combination of in-house search techniques and field inspections to identify and enforce against unlicensed businesses. The unit demonstrates a high rate of success in achieving compliance.

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[2] There is no clear legal definition of what it means to file an accusation but it is generally understood to mean the date that an accusation is signed by the BAR Chief. The law could probably benefit from additional clarity in this area as well.
[3] As mentioned earlier, the standard is three years except for cases of fraud.
[4] Once a case is filed, the timeline is controlled by the Attorney General and the Office of Administrative Hearings.

INTRODUCTION

Mission of the BAR

The mission of the BAR is to protect and serve California consumers by ensuring a fair and competitive automotive repair marketplace and implementing a model motor vehicle air quality improvement program.

The mission of the Department of Consumer Affairs (DCA), of which the BAR is a unit, is to protect and serve consumers while ensuring a competent and fair marketplace.

A significant distinction between the two missions is the BAR's incorporation of an environmental protection goal (i.e., promoting air quality) in it's mission where the DCA mission focuses solely on consumer protection. The BAR air quality enhancement goal is implemented through the Bureau's enforcement of smog check station rules and procedures.

History of the BAR

The Automotive Repair Act was passed 1971 through Senate Bill 51 (SB51) (Beilenson). The act mandated a statewide consumer protection program for the auto repair industry and a system of registering auto repair dealers (ARDs). In 1972 the BAR was established within the Department of Consumer Affairs (DCA). The Automotive Repair Act was codified in Business & Professions Code (B&P Code), Chapter 20, sections 9880 et seq.

In 1977, amendments to the Federal Clean Air Act required those states not meeting air quality standards to implement Inspection and Maintenance (I/M) programs whereby vehicles would be tested for compliance with emission standards at smog check facilities. In 1982 the BAR was given responsibility for enforcing smog check station rules and standards.

In 2003, a Sunset Review[5] was conducted that attracted significant interest from the auto repair and smog check industry. Extensive criticism was directed at agency management for what was perceived to be heavy-handed enforcement tactics, constricted due process rights and insensitivity towards the concerns of the industry. In response the state legislature sponsored Senate Bill 1542 (SB 1542) (Figueroa) to establish the position of

[5] Sunset reviews are conducted periodically by state government to determine if a program is meeting the objectives of the enabling legislation, operating efficiently or accomplishing it's mission. Usually a sunset review coincides with a pre-programmed opportunity to either reauthorize the existence of the program, change it or shut it down.

Enforcement Monitor to investigate the claims put forth by industry and evaluate the fairness of the agency's practices. Enforcement monitors have been appointed for other state consumer protection boards and bureaus in the past so the appointment of a monitor for the BAR was not unprecedented for state government.

Snapshot of the BAR

The BAR employs 551 staff in 12 field offices around the state in addition to the Sacramento headquarters. These field offices allow BAR staff to be close to licensees[6] and consumers. The BAR also has seven documentation labs where state-owned vehicles are prepared for conducting undercover operations.

About half of the staff are employed as Program Representatives, a title denoting an investigator that responds to, and investigates complaints, conducts formal investigations, pursues disciplinary actions. Program reps also provide formal and informal coaching and education for members of industry on ways to comply with auto repair and smog check regulations.

The agency is organized functionally with three major divisions:

- Smog Check Engineering and Operations,
- Consumer Assistance and Administration, and
- Field Operations and Enforcement.

Most of the activity addressed by the Enforcement Monitor project occurs in the Field Operations and Enforcement Division.

Legal authority for BAR operations is found in three main sources:

- B&P Code 9880 et seq. – commonly called the Auto Repair Act. This series of statutes covers the consumer protection part of the BAR. This statute was originally passed in 1971.
- Health & Safety (H&S) Code Sections 44000 et seq. – This series of statutes covers the oversight of smog check stations. The portion most relevant to the BAR and this project is Section 44014 et seq.
- These statutes are backed up by regulations found in Chapter 1, Division 33 of Title 16 of the California Code of Regulations (CCR).

The BAR is a self-supporting agency and does not rely on state general fund support. In FY 2003-04 the BAR had a budget of $108 million. Key revenue sources include smog check fees paid by consumers and licensing fees paid by ARDs and smog, lamp and brake stations and technicians.

[6] Auto repair dealers are "registrants" and smog check stations and technicians are "licensees." Since many of the findings and recommendations in this report apply to both, for convenience the term "licensee" is used for both types of businesses.

Key workload statistics include (all figures are for FY 2002-03 unless otherwise noted):[7]

- 41,000 registered ARDs (these include smog check stations which are required to have an ARD registration as well as a smog check facility license)
- 670 educational presentations held
- 23,000 complaints received
- 24,000 complaints closed
- 7,000 complaints referred to BAR field offices for investigation
- Top 3 complaint categories:
    1. Auto body/auto glass repair
    2. Steering/brake repair
    3. Transmission repair
- 21,000 inspections of smog check facilities[8]
- 2,170 investigations of auto repair and smog check locations[9]
- 581 office/citation conferences held
- 1,302 citations issued to smog check licensees with total amount fined of $457,000
- 238 cases referred to the Attorney General for disciplinary action
- 172 cases referred to local prosecutors for criminal prosecution
- 137 stipulated settlements
- 295 licenses revoked

Project objectives

Objectives for the Enforcement Monitor program were covered in SB 1542, the bill authorizing the Enforcement Monitor. The specific language of the bill is shown in Appendix 2 but is summarized below:

- Examine the accuracy and consistency in the application of sanctions or discipline,
- Evaluate the viability and fairness of procedures available to licensees and registrants to respond to allegations of violations,
- Evaluate the accessibility, fairness and independence of the appeals process,
- Evaluate the prioritization of investigatory and prosecutory resources,
- Evaluate the expertise of bureau staff in accepted industry standards,
- Evaluate the effectiveness of DCA's ombudsman and advisory committee,

[7] Most numbers are approximations.
[8] Smog check stations are inspected twice a year.
[9] The majority of investigations are triggered by complaints (in the case of auto repair establishments) or evidence of compliance issues (in the case of smog check stations).

- Analyze and consider a statutory definition of the term "fraud" and how it applies to licensees and registrants,
- Analyze and consider the establishment of formal diagnostic and repair standards,
- Analyze and consider the licensing or registration of technicians,
- Consider the establishment of a formal code of conduct, and
- Evaluate the processing of complaints and investigations.

Procedures performed

Strategica, Inc. performed the following procedures during the Enforcement Monitor project to date:

- Conducted an entrance conference,
- Met industry stakeholders at a series of forums held throughout the state,
- Interviewed 45 BAR employees, legislative staffers, prosecutors, industry representatives, defense attorneys, consumer advocates,
- Read 34 reports and other documents (e.g., BAR plans, reports and letters from industry reps, educational materials, statutes & regulations),
- Developed an essential elements of due process list and compared it to the Administrative Procedure Act (APA),
- Conducted 12 ridealongs with BAR program reps and observations of office conferences and administrative hearings,
- Observed DCA staff at 2 mediation centers,
- Mapped processes for investigating complaints and handling disciplinary matters,
- Audited 24 cases for due process, consistency,
- Examined the legal basis for various elements of the Auto Repair Act and the APA,
- Examined features of other regulatory practices at peer agencies such as the Alcoholic Beverage Commission, the Medical Quality Board and the Contractors State License Board,
- Researched shop management software systems and contacted software publishers,
- Researched arbitration systems in California and Washington,
- Researched and drafted brake system trade standards, and
- Researched data on program representative training, unlicensed activity enforcement, charging timelines and case prioritization, and minimum penalty guidelines.

FINDINGS AND RECOMMENDATIONS

Shop Management Systems

Based on our field observations it becomes apparent that a key factor in achieving compliance with the Automotive Repair Act[10] and the Health & Safety Code is the quality of the shop management computer systems used by ARDs and smog check stations. The Enforcement Monitor noted that these systems are not always programmed or installed correctly. For example, a system will not be programmed with complete descriptions of labor and part items or the system does not automatically print two copies of an estimate (one for the shop and one for the consumer). These system problems potentially cause many inadvertent violations of the Act. Conversely, a well functioning system can not only benefit the consumer by improving the quality of the transaction but can reduce risk for the shop owner.

The marketplace for shop management systems is highly fragmented. Based on anecdotal information, the market leader, Mitchell-on-Demand, has no more than 20% of the market for shop management computer systems.[11] The remainder of the market is spread among at least 60 different software providers. In addition, about half of all repair shops do not even use a shop management system, instead hand writing estimates and invoices. For this reason, any initiative for improving the state of these systems would have to appeal to a broad base of software providers to have an impact.

Currently, the BAR does not have a proactive process or program for working with software providers to improve the functionality of their systems. BAR staff have occasionally met with representatives from repair businesses or major chains to review a form template or a computer function. Software providers we spoke to were supportive of some kind of proactive collaboration with the BAR so they could produce better system specifications and functions for their customers.

It should be noted that while this collaboration could be very useful and beneficial for the BAR, software providers, consumers and the repair industry it could not take the form of a guarantee that the software or the documents produced by the software is in compliance with the Auto Repair Act or the H&S Code or that using the software would automatically result in compliance. Too many other factors are involved that could produce a violation even if the software was installed at a repair business. For example, the software could be installed improperly or otherwise misued.

[10] Business & Professions Code Section 9880 et seq.

[11] All Data is another significant supplier.

Recommendation 9 – Implement annual or semi-annual technical conferences for shop management software providers. Offer technical reviews of software products on request. These conferences should provide an opportunity for software providers to discuss system features and controls, demonstrate software, and plan for program updates. BAR staff could discuss non-compliance and violation trends and how software features and controls could help to mitigate these trends. The BAR should also offer to provide technical reviews of software outside of the technical conferences on request should a provider prefer a more private setting.

Brake Diagnosis Standards

Based on interviews, ridealong observations and the results of the case audit it became apparent that a frequent source of complaints, violations and fraud involve brake diagnosis and repair. Interview feedback suggests that standards for diagnosing brake problems and communicating these problems to consumers would be helpful by instilling a higher level of objectivity and specificity in brake problem diagnoses and giving consumers a more informed basis for making repair decisions. A useful model for this type of standard are the existing standards for ball joints found in CCR 3360. These standards deal with similar issues of diagnosis and communicating with consumers and could be adapted for brakes as well.

Recommendation 10 – Convene a committee of regulators, consumer advocates and industry to explore the feasibility of regulations on brake standards. A potential outline for a brake diagnosis regulation could include the following:

- Measurement of brake components should be performed with a device manufactured for that purpose. Measurement should be in fractions of an inch or millimeters whichever is used for the vehicle model.
- Replacement of brake rotors, shoes or pads should be accompanied by recording on the customer's invoice the degree of wear on the component replaced and the manufacturers recommended maximum allowable wear for the component.
- Before brake calipers or wheel cylinders are to be replaced in a vehicle, the component shall be inspected and the condition of the component shall be disclosed to the customer.
- Brake fluid is not to be replaced unless the quality of existing fluid is degraded beyond OEM specifications and subject to disclosure and consent from customer.
- Sale and installation of brake components is permitted subject to compliance with the preceding requirements and with consent of the customer.

Limitations

State law contains statutes (B&P 9889.8 and H&S 44072.7) setting time limits for filing accusations against brake and lamp stations and smog check stations. These statutes set a

limit of three years between the date of a violation and the date an accusation is filed.[12] There is an exception in cases of fraud where the limitation is two years between the date the fraudulent activity is discovered by the BAR and the date an accusation is filed. Many otherwise informed individuals have assumed that B&P 9889.8 applied to all cases filed against ARDs however a careful reading of the statute will reveal that it only applies to brake and lamp stations. The result is that, in fact, there is no limitation that applies to ARDs that do not fall into the categories of brake and lamp stations or smog check stations.[13] This absence of a statutory limitation can be disadvantageous to the accused ARD as it makes preparing a defense much more difficult. Defense witnesses may be unavailable, records may have gone missing, etc. It is also disadvantageous to consumers as the ARD is allowed to stay in business potentially committing more violations. This appears to be an oversight on the part of the legislature that can easily be rectified.

Recommendation 11 – Amend the Auto Repair Act to include limitations for CPO filings in Section 9884 of the B&P Code. These new limitations can be modeled after B&P Code 9889.8 or H&S Code 44072.7 which cover brake & lamp and smog check respectively.

Minimum Penalty Guidelines

Title 16 of the CCR contains penalty guidelines for violations of key provisions in the B&P and H&S Codes. These guidelines are not binding on Administrative Law Judges or DCA and in fact our case audit shows that a large proportion of cases are decided with a lesser sanction than the guidelines suggest. However, in some cases there is a wide disparity between provisions addressing smog check violations and auto repair violations. These encompass violations addressing preparation of estimates and invoices. Minimum penalty guidelines for auto repair include:

- B&P 9884.8 – improper invoice – 10 days suspension, 2 years probation
- B&P 9984.9 – no written estimate – 10 days suspension, 2 years probation[14]

Minimum penalty guidelines for smog check include:

- H&S 44033(c) – failure to provide written estimate – 30 days suspension of station license, 2 years probation[15]
- H&S 44033(d) – failure to state separately charges for testing and repairs – 30 days suspension of station license, 2 years probation[16]

As seen above, penalties for smog check violations are significantly harsher than those for similar violations in the auto repair area. For many thinly capitalized auto repair businesses

[12] There is no clear legal definition of what it means to file an accusation but it is generally understood to mean the date that an accusation is signed by the BAR Chief. The law could probably benefit from additional clarity in this area as well.
[13] In some cases the doctrine of laches would apply. This doctrine provides relief to parties that are prejudiced by unreasonable delays or negligence on the part of claimant pursuing a claim against that party. In the present context and in plain English it prevents a regulatory agency from pursuing a case against a regulated business after unnecessary, excessive or unreasonable delays in pursuing that case.
[14] Actual guideline is 90 day suspension, 80 days stayed.
[15] As stated in Guidelines for Disciplinary Penalties and Terms of Probation, Sept. 2003, published by DCA.
[16] Ibid.

a 30 day suspension, as suggested for smog check stations, is tantamount to closing the business down due to the lost revenue and reputation.[17]

Another problem with the guidelines is that the numbering system for identifying statute sections is not consistent with the actual statute. For example, the guidelines refer to Section 9884.7(a) - false and misleading statements, where the actual statute refers to this as 9884.7(a)(1). Finally, many violations as referenced in statute do not have a corresponding entry in the disciplinary guidelines.

Fortunately, the BAR has prepared and submitted a Regulation Change Proposal dated 12/28/05 that clears up all of these problems. This proposal must clear a range of review and comment steps before being formally promulgated.

Recommendation 12 – Continue pursuing adoption of the Regulation Change Proposal to improve and clarify the disciplinary guidelines.

Policies on Non-Adopted Decisions

A request was made at the Senate Committee on Business, Professions & Economic Development hearing on 12/7/05 to determine whether a formal policy was used by DCA legal staff when deciding when to exercise the non-adopt provision of the Administrative Procedures Act [GC 11517(E)]. The DCA legal staff provided a letter dated 2/24/06 listing these factors for making non-adopt decisions:

1. Is the proposed sanction consistent with the disciplinary guidelines established by the BAR in regulation?
2. If not, are the facts or circumstances of the case sufficient to warrant deviation from those guidelines?
3. Has the Administrative Law Judge (ALJ) applied the appropriate legal standard of proof?
4. Does the record support the findings of fact made by the ALJ (both testimonial and documentary evidence)?
5. If probation is suggested, has the ALJ omitted any of the critical standard terms and conditions?

Obviously it is impossible to determine whether these factors are actually weighed in each non-adopt decision. The factors seem reasonable and would doubtlessly improve the quality of case decisions. As mentioned in the Year One Report, any case that goes to an administrative hearing has a six percent chance of being non-adopted and subsequently decided with a harsher sanction. Of the cases we reviewed that had been non-adopted, only one appeared to be decided with a sanction that was not proportional to the violation and the mitigating/aggravating factors. Nevertheless, as we conveyed in our earlier report we favor eliminating the non-adopt for BAR cases for the following reasons:

[17] It should be noted that very few cases involve solely these types of violations (e.g., paperwork violations). Typically these violations are combined with other issues such as fraud. In our case audit we found only one case that was decided solely on a paperwork violation and it actually involved fraud.

1. Since DCA legal staff rely solely on the written record of a hearing, they are not in a position to review the evidence first-hand, observe testimony, the demeanor of witnesses, etc. as the ALJ is. Unless it appears that the ALJ is clearly in error in fact finding and applying discipline it seems that he or she is in a better position to judge the veracity of the evidence and make factual determinations.

2. The existence of the non-adopt provision and the uncertainty it instills in the administrative hearing process[18] creates a disincentive to respondents in seeking a hearing (above and beyond the potentially considerable cost of a defense). This is contrary to a traditional goal of a judicial system eliminating barriers to the judicial process for litigants. This disincentive is even more pronounced given the perception of respondents that the ultimate decision maker is not an unbiased ALJ but the ostensibly biased head of a consumer protection agency or their legal advisor.

As the Year One Report states, the non-adopt provision is supported by case law. The question is whether the legislature should eliminate its use in BAR cases in the interests of enhancing due process, fairness and promoting economic development.

Recommendation 1 (repeated from the Year One report) – The Legislature should exclude the non-adopt provision from the Auto Repair Act. The Auto Repair Act section that specifies using the Administrative Procedure Act for a BAR hearing (Section 9884.12) should be amended to exclude Government Code Section 11517. The rest of the APA would still apply.

Arbitration

Binding arbitration is used in the Contractors State Licensing Board (CSLB) with some success. The CSLB operates both voluntary and mandatory arbitration programs with a $7,500 maximum dispute amount for the mandatory program. The program handles approximately 600 arbitrations per year although the number has been declining in recent years. CSLB arbitration cases mostly involve workmanship issues; fraud cases are handled on a separate disciplinary track. The Enforcement Monitor considered whether a similar program could be adapted for the BAR where 20,000 mediations are conducted annually. Since a high proportion of these cases are disputes over workmanship rather than violations of the Auto Repair Act or smog check statutes they may be amenable to an arbitration approach.

Two significant impediments preclude the successful adaptation of arbitration within the BAR:

1. Arbitration is costly. CSLB spends approximately $1.1 million per year on its arbitration program or about $1,800 per arbitration. This cost includes the cost of contract arbitrators, paid expert witnesses and administrative support. A trimmed down program within BAR (e.g., staff arbitrators, no paid experts) would cost around $900 to $1,000 per arbitration which is more than most of the repair bills in question.

[18] Ten percent of cases that go to hearing are subsequently non-adopted. Of these, 60 percent are decided with a harsher sanction.

2. Mandatory arbitration was attempted at the BAR during 1984-87 as part of a larger repair shop certification program called the "Better Automotive Repair Program." The arbitration element was a condition to participate in the program whereby repair businesses underwent inspections and were certified as adhering to a higher standard of business conduct. Unfortunately, the program did not recruit enough businesses nor was public awareness sufficient to warrant continuation of the program and it sunsetted in 1987. The arbitration element was also unpopular with businesses especially if they lost an arbitration case.

For these reasons we do not recommend that arbitration be used for BAR cases at the present time.

Program Rep Training

BAR Program Representatives are required to take 132 hours of training during their first year and 40 hours of training every year thereafter. The initial training covers a broad range of subjects such as mediation techniques, BAR laws, policies and procedures, report writing and defensive driving. Annual required training includes coursework in policies and procedures, engine performance and emission systems. In addition, supplemental training is offered on a variety of automotive technical subjects. About a quarter of this training is contracted from outside vendors. Actual 2005 data on training shows an average of 50-60 hours of attendance per year per Program Rep, well above the requirement.[19]

Charging Timelines

Limitation statutes in the Auto Repair Act and the H&S Code require that accusations be filed within three years of a complaint or alleged violation.[20] If fraud is alleged, the timeline is two years starting when the fraud is discovered by BAR. There is no statutory requirement for the elapsed time between filing an accusation and arriving at a decision (either through default, a hearing or settlement.)

An analysis of actual case investigation, filing and decision making timeline data reveals the following:

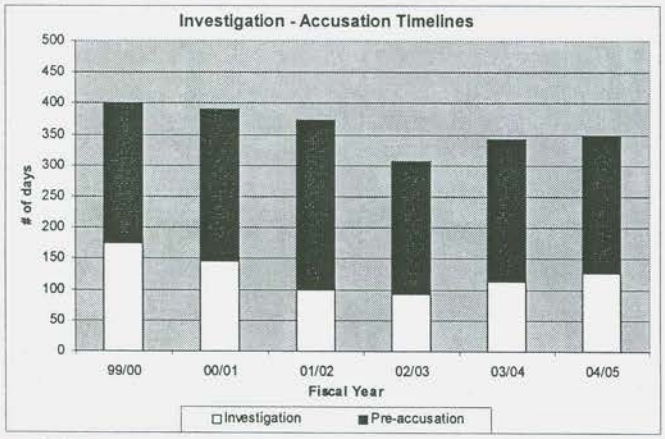
- Mean time for investigating a case is 127 days,
- Mean time between preparing the investigative report and filing an accusation is 221 days,
- The total mean time between opening an investigation and filing an accusation is 348 days, well within the three-year statutory timeline,

[19] Breaking out the actual training hours between year one and ongoing training was not possible however all year-one courses were offered in 2005.

[20] As mentioned earlier there is not statutory definition of when "filing" occurs. It is generally considered to mean the date that an accusation is signed by the head of a regulatory agency.

- The mean time between filing an accusation and arriving at a decision is 449 days. It should be noted that most of this activity is under the control of the Attorney General, not the BAR, therefore it is beyond the scope of this project nor is there an established time limitation. These timelines have been fairly consistent from year to year as the following graphic shows:

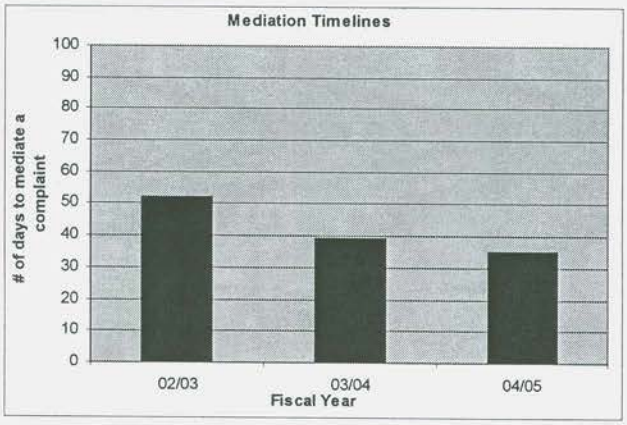
Figure 1 – BAR disciplinary case processing timelines



Source: BAR

The next graphic shows the average number of days to mediate a complaint. As seen in the chart, the number of days required has been trending downward. In FY 04/05 it was 35 days.

Figure 2 – BAR disciplinary case processing timelines



Source: BAR

Unlicensed Activity

The BAR has organized a unit specializing in addressing the problem of unlicensed repair shops called the Registration Enforcement Unit (REU). The REU is comprised of 12 staffpersons, 7 in BAR headquarters and 5 in the field. REU staff identify potentially unlicensed businesses from a variety of sources including business license applications submitted to cities, filings with the State Board of Equalization, phone directories and receiving complaints. If headquarter staff are not able to contact the business to determine its status and/or achieve compliance, a referral is made to a field investigator who will then visit the location. Many allegedly unlicensed businesses turn out to not be involved in auto repair or are out of business. The majority of those that are operating out of compliance are merely delinquent on renewing their license. There is a backlog in pending field investigations in southern California due to a couple of unfilled positions but the rest of the state is otherwise well covered.

Performance data for the REU shows a high rate of compliance. REU headquarters staff registered 2,620 ARDs in FY 2004/05 with approximately 10% of these handled as initial registrations as opposed to delinquencies. REU field staff registered 1,700 ARDs with 40% of these initial registrations. Again, many investigations reveal that the business is gone or not involved in auto repair. Independent motorcycle repair businesses are the most problematic with regard to compliance.

Updated Case Audit Statistics

An extensive audit of closed disciplinary case files was conducted for the Year One report. For this report we added eight additional cases (a 50% increase in the audit sample). The following text describes updated findings from the additional cases.

The case audit sample (for all cases) had the following characteristics:

- 24 total cases

- 4 cases were resolved through stipulated settlements
- 19 cases were resolved after an administrative hearing
- 1 case was dismissed by the ALJ because it exceeded the limitation statute[21]

- 7 cases were selected by the BAR[22]
- 11 cases were selected at random by the Enforcement Monitor
- 6 cases were referred by industry

- 15 cases were for auto repair dealers
- 9 cases were for smog check stations

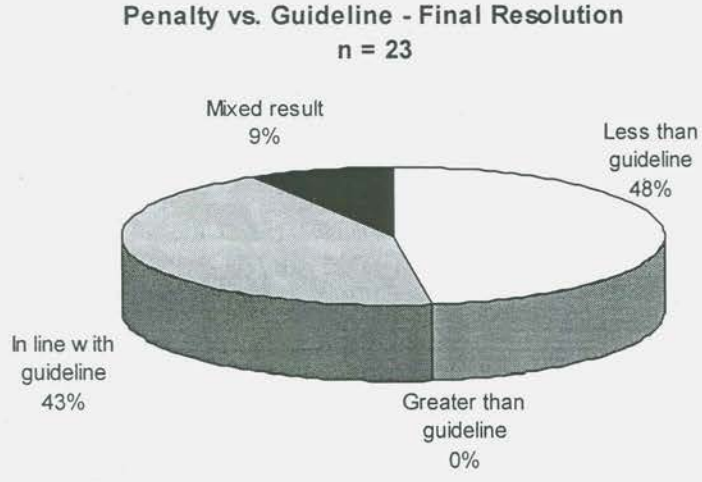
- 7 cases were non-adopt decisions

[21] In reality, there was no limitation. See earlier discussion on limitation statutes.
[22] BAR was asked to select some cases for the sample because we wanted to review recent non-adopt cases. BAR staff were in a position to identify these cases.

The BAR has prepared Guidelines for Disciplinary Penalties and Terms of Probation[23] that establishes a range of sanctions for common violations of the Repair Act and the Health & Safety Code. For example, the range of sanctions for violating B&P Code 9884.7(a)(1), making false and misleading statements, would be revocation on the high end and a 10-day suspension[24] plus 2 years of probation on the low end. Like most sentencing guidelines used in judicial environments, the disciplinary guidelines are intended to instill consistency in how sanctions are applied so that there is a greater nexus between violations and penalties.

To ensure that cases are not being resolved with greater or lesser sanctions than called for in the guidelines we compared final decisions with the published guidelines in our audit.[25] The following chart shows our results:

Figure 3 – Penalty vs. guidelines – final resolution



Source: BAR case files

As seen in the chart, 43% of cases in our sample were decided within the guidelines. The chart also shows that cases are frequently decided with a sanction that is less than the guidelines. In fact, of the seven non-adopt decisions in our sample, three were ultimately decided with sanctions less than the guidelines which shows that under-sanctioning is not just within the realm of ALJs. The audit also showed that no cases were decided at a sanction that was more than the guidelines although the highest sanction for most violations is revocation so it would be hard to exceed this sanction.

One concern raised was the alleged lack of a connection between the nature of a complaint and how cars are prepared for undercover runs sent to the business that was the subject of the complaint. The perception is that the inducements prepared on undercover vehicles are dissimilar to the nature of complaints. In our audit, five cases had both a complaint and at least one undercover run. In four of the five cases the nature of the inducement was, in fact, similar to the complaint.

[23] Published September 2003.
[24] The guidelines actually call for a 90-day suspension with 80 days stayed or reduced.
[25] Final decisions incorporate those decisions made after a non-adopt. One case in the audit was dismissed so the total number of cases covered in the graphic is reduced by one.

Status of Prior Recommendations

The following pages list the recommendations from the Year One report and the status of implementation. Note that Recommendation 8 has been changed from the Year One Report.

Recommendation 1 – The Legislature should exclude the non-adopt provision from the Auto Repair Act. Status: No progress.

Recommendation 2 – The BAR should amend office conference reports to include an acknowledgement at the end of the report regarding the attendee's understanding of what was discussed and the purposes of the conference. Status: In Progress.

Recommendation 3 – The Legislature should amend B&P Code 125.3 directing DCA to pay all actual legal fees incurred by licensees where the BAR was not able to prove a substantial number of the allegations in an administrative hearing. Status: No progress.

Recommendation 4 – DCA should enhance the guidelines and authority of the ombudsman. Status: In Progress.

Recommendation 6 – The Office of Administrative Hearings should establish a dedicated panel of judges for BAR cases. Status: No progress.

Recommendation 7 - Implement recommendations from the Auto Body Repair Inspection Pilot Program Report to the Legislature. Status: No Progress.

Recommendation 8 – Establish a system of required testing and licensing for service writers covering basic knowledge and application of the Auto Repair Act and sound business practices. Provide training on tested material on a voluntary basis through classroom, on-site or self-directed methods (e.g., a DVD). In addition, license at least one beneficial owner of ARDs. Status: No progress.

Attachment I

April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance Smog Check Program

APRIL 2004 EVALUATION OF THE CALIFORNIA ENHANCED VEHICLE INSPECTION AND MAINTENANCE (SMOG CHECK) PROGRAM

Report to the Legislature

Submitted by:

Air Resources Board
and
Department of Consumer Affairs/Bureau of Automotive Repair

September 2005

--FINAL--

April 2004 Evaluation of California's Enhanced Vehicle Inspection and Maintenance (Smog Check) Program

Report Completion Date: April 2004

Addendum Completion Date: September 2005

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This report is available for downloading from the Air Resources Board Internet website at **http://www.arb.ca.gov/msprog/smogcheck/smogcheck.htm**. To obtain this document in an alternative format, please contact the Air Resources Board ADA Coordinator at (916) 322-4505, TDD (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area.

This report has been reviewed by the staff of the Air Resources Board and the Department of Consumer Affairs Bureau of Automotive Repair and approved for publication.

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2005 Addendum to the April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program Draft Report to the Inspection and Maintenance Review Committee

This 2005 Addendum finalizes the *April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program, Draft Report to the Inspection and Maintenance Review Committee* (Report), and provides an update on what has happened since the draft Report release. The Addendum includes discussion of the Report's public review process, subsequent legislative action including restoration of funding for the Bureau of Automotive Repair's (BAR) vehicle retirement program, and correction of minor errors discovered during the review process.

This finalized report satisfies applicable legislative reporting requirements. Health and Safety Code Section 44003(a)(2) and uncodified Section 15 of Chapter 803 of the Statutes of 1997 require ARB and BAR to jointly report to the Legislature on the status and effectiveness of California's enhanced vehicle inspection and maintenance (Smog Check) program, and make recommendations for improvement by January 2003. Section 15 also directs the California I/M Review Committee (IMRC) to review the program proposed by ARB and BAR and issue its own report to the Legislature by July 1, 2003.

Public Review Process

The public has been given an opportuntity to review the Report as part of the IMRC review process. The IMRC invited ARB and BAR to present the Report for public comment at three IMRC meetings. On January 27, 2004, prior to the release of the draft Report to the IMRC, ARB and BAR jointly outlined the Report recommendations at an IMRC meeting. After the draft Report was released on April 19, 2004, ARB and BAR jointly presented the full Report and responded to public comment at the IMRC meeting on June 22, 2004. The meeting was noticed on both the IMRC and ARB websites and broadcast via the Internet on ARB's website to increase public participation. The public was able to send questions via email during the meeting. In order to receive public comment on the analysis used to quantify the impacts of the recommendations, ARB and BAR staff also outlined for the IMRC, on May 17, 2004, a technical support document for the Report. This document was released on June 9, 2004. Both the Report and technical support document can be accessed via the ARB website, at www.arb.ca.gov/msprog/smogcheck/smogcheck.htm.

During the public review process, ARB and BAR received five comment letters. Four of these letters raised concerns regarding the number of vehicles directed to test-only stations. This comment topic did not focus on ARB's and BAR's recommendations. One of the four letters conveyed the concern that the Report's recommendations to eliminate the 30-year rolling exemption and annually inspect older vehicles would, if implemented, disproportionately impact classic vehicle and low-income vehicle owners. As indicated in the Report, some motorists would qualify for financial assistance for repairs. At select Smog Check stations, BAR provides financial repair assistance up to $500, with a $20 co-payment, for consumers who are considered

low-income. In addition, the vehicles affected by these recommendations are already in the Smog Check inspection program.

The final comment letter conveyed concerns regarding the manner in which the Smog Check benefits and emission reductions were calculated, including the methodology for estimating the benefits from the smog check inspection cycle contained in ARB's emissions estimation model, EMFAC2002. ARB is in the process of updating EMFAC2002 to incorporate the latest available data regarding vehicle population, vehicle emissions, and travel activity. In a response letter, ARB encouraged the commenter to participate in the separate public process for updating the emissions estimation model.

Actions by the Legislature and the IMRC Following Release of the Draft Report

Since the release of the report, the Legislature has passed laws affecting four of the Report's recommendations.

30-Year Rolling Exemption. ARB and BAR recommended eliminating the 30-year rolling exemption and replacing it with a pre-1976 exemption. Governor Schwarzenegger signed AB 2683 (Lieber, Chapter 704, Statutes of 2004) amending State law to replace the 30-year rolling exemption with a pre-1976 exemption effective April 1, 2005. By implementing this recommendation, 5.7 tons per day of smog-forming hydrocarbons (HC) and nitrogen oxides (NOx) will be reduced in the Enhanced areas in 2010.

Clean Screen 5/6 Model-Year Vehicles. The Report also recommended a program to except from biennial inspections clean five and six year old vehicles, model-years one through four were already exempted. SB 1107 (Budget and Fiscal Review Committee, Chapter 230, Statutes of 2004) amended State law beginning January 1, 2005, excepting all vehicles five and six years old from biennial Smog Check inspection. Removing the fifth and sixth model-year vehicles from the biennial Smog Check program will allow an emissions increase of 2.6 tons per day HC and NOx in 2010. However, under SB 1107, the expanded Carl Moyer program will recover these lost benefits ten-fold, as well as provide over $6 million per year in Smog Check repair assistance to low-income motorists.

Except Two-Year and Newer From Change of Ownership Inspection. ARB and BAR also recommended that vehicles two years old or less be excepted from change of ownership inspections. SB 1107 further amended State law, beginning January 1, 2005, to exempt the first four model years from change of ownership inspection requirements. Exempting the first four model years from change of ownership testing allows an emissions increase of less than 0.5 ton per day HC and NOx.

Improve Station Enforcement Actions. ARB and BAR recommended improving the enforcement of the Smog Check program by restoring staff positions, establishing a specialized prosecution unit within the Attorney General's office, and retaining an Administrative Law Judge dedicated solely to Smog Check. SB 1542 (Figueroa, Chapter 572, Statutes of 2004) requires the Department of Consumer Affairs to appoint, by January 1, 2005, a BAR Administrative and Enforcement Monitor to evaluate BAR by December 31, 2006. This Monitor

is charged with analyzing BAR's practices and procedures rather than directly improving station enforcement. Even though the Legislature did not act on our recommendation, once appointed, the new Monitor may consider our recommendation when reporting back to the Legislature.

Also, in 2004, the Legislature restored funds to BAR's vehicle retirement program, which had been unfunded since 2002. The vehicle retirement program is available to motorists who want to voluntarily retire their vehicles rather than repair them. Eligible consumers can receive $1000 in exchange for their vehicle. For the 2004/2005 fiscal year, $4.5 million was made available for vehicle retirement and for the 2005/2006 fiscal year, the budget was increased to $16.3 million.

In January 2005, the IMRC completed its review of the ARB/BAR report and made its own recommendations for improvements. The IMRC concurred with five out of the eight ARB/BAR Report recommendations and provided additional comments on two other recommendations. The IMRC did not comment on the ARB/BAR recommendation for more stringent cutpoints for after-repair tests. In a January 19, 2005 letter to IMRC, BAR suggested that the impact of recent legislation, and the technical feasibility, cost-effectiveness of the emission benefits, and socio-economic impacts, be fully understood before implementing annual inspections of older vehicles, annual inspections of high mileage vehicles, and including a smoke test as part of the Smog Check inspection.

Corrections

In the review process, ARB and BAR discovered some errors in the Report's cost effectiveness assumptions. The Report and technical support document have been modified to correct these errors, as discussed below.

The cost effectiveness calculations for replacing the 30-year rolling exemption with a pre-1976 model year exemption, for annual testing of vehicles over 15 years old, and for annual testing of taxicabs have been corrected to include the certification fee. The additional $8.25 cost per vehicle diminishes cost effectiveness slightly. The cost effectiveness figure for replacing the 30-year rolling exemption with a pre-1976 model year exemption increases from $7,300 per ton to $7,900 per ton. The cost effectiveness for annual testing of vehicles over 15 years old increases from $8,500 per ton to just under $10,000 per ton.

The cost effectiveness for annual testing of taxicabs has also been corrected to be consistent with the emission reductions presented in the Report. The emission reductions in the Report are based on a comparison of before and after repair emission rates for taxicabs. The cost effectiveness that was presented in the draft report, however, used smaller emission reductions that were based on a comparison of before repair and taxicab fleet average emission rates. The net impact of including the certification fee and basing the calculation on larger emission reductions is to improve the cost effectiveness for annual testing of taxicabs, from $10,000 per ton to $6,900 per ton.

1 Executive Summary

California's enhanced vehicle emissions inspection and maintenance (I/M or Smog Check) program is achieving emission reductions needed to meet health-based air quality standards. This report quantifies the effectiveness of the enhanced Smog Check program as of the end of 2002 and discusses pending enhancements that are designed to further improve program benefits. It also presents recommendations for statutory changes designed to provide additional emission reductions and to make the program friendlier to consumers.

1.1 Current and Future Program Effectiveness

This report focuses on the current effectiveness of the enhanced Smog Check program. This program is in place in the urbanized parts of California with the most challenging air quality problems – the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, Ventura County, and, starting in 2003, the San Francisco Bay Area. The enhanced program is just one part of California's overall Smog Check program. Basic Smog Check testing is required biennially in other populated parts of the State, and a basic Smog Check is required upon change of vehicle ownership in rural parts of California. In 2002, about 65 percent of the California fleet was subject to the enhanced program, 32 percent to the basic program, and the remaining three percent to change of ownership testing. To put the assessment of the emission reductions being achieved from the enhanced program in a broader context, Table 1.1 presents the overall statewide emission reductions from the Smog Check program for 2002 based on the EMFAC2002 emissions model. These include the benefits for the entire State – from enhanced, basic, and change of ownership areas. For comparison, the overall emissions from gasoline powered vehicles in 2002 are about 830 tons per day (tpd) hydrocarbons (HC), 8,570 tpd carbon monoxide (CO), and 850 tpd nitrogen oxides (NOx). The enhanced program emission benefits presented later in the report are a subset of the total program benefits shown in Table 1.1.

Table 1.1: Total Statewide I/M Emission Benefits for Calendar Year 2002 (Enhanced + Basic + Change of Ownership Areas) Based on the EMFAC2002 Model

HC (tpd)	CO (tpd)	NOx (tpd)
211	1,360	158

Evaluation of 2002 Program Benefits

Two approaches were used to evaluate the emission reductions in 2002 from California's enhanced I/M program relative to basic I/M: (1) an analysis of emissions tests from roadside pull-over programs conducted by the Department of Consumer Affairs' Bureau of Automotive Repair (DCA/BAR); and (2) an analysis of the results from the Air Resources Board's (ARB's) EMFAC2002 motor vehicle emissions model. Table 1.2 presents the estimated percent reduction in fleet exhaust emissions resulting from the enhanced Smog Check program in 2002, based on both analytical approaches. Overall, the fleet exhaust emissions were reduced by about

13-15 percent for HC, 14-15 percent for CO, and 9-12 percent for NOx when compared to the basic program emission rates. There is relatively good agreement between the two different approaches used to estimate the enhanced I/M benefits relative to the basic I/M program.

Table 1.2: Exhaust Emission Benefits of Enhanced I/M Relative to Basic I/M in Calendar Year 2002 (Based on Average Fleet Emission Rates)

Analysis Type	HC Emissions (% Reduction)	CO Emissions (% Reduction)	NOx Emissions (% Reduction)
Roadside Data Analysis	15%	14%	9%
EMFAC2002 Analysis	13%	15%	12%

The EMFAC2002 model was also used to estimate the additional "tons per day" emission reductions achieved from enhanced I/M in 2002 compared to the basic program, as shown in Table 1.3. To put the enhanced I/M emission reductions in context, Table 1.3 presents the overall I/M emission reductions for enhanced areas in 2002, separated out into the benefits that would be realized if only the basic program were in place and the additional benefits from the enhanced program. As the table shows, the addition of the enhanced program requirements has more than doubled the Smog Check benefits for these areas. The 106 tpd HC, 672 tpd CO, and 76 tpd NOx of emission reductions from the enhanced program beyond the basic requirements are equivalent to removing two million vehicles from California's roads, making enhanced Smog Check one of the single largest emission reduction programs in California. (Note that the total benefits shown in Table 1.3 do not match those in Table 1.1 because Table 1.3 presents the reductions only for the 65 percent of the State subject to enhanced I/M in 2002 while Table 1.1 presents the reductions for the entire State.)

Table 1.3: Total I/M Emission Benefits for Enhanced Areas in Calendar Year 2002 Based on the EMFAC2002 Model

Enhanced Area Benefits	HC (tpd)	CO (tpd)	NOx (tpd)
Benefits from Basic I/M Requirements in Enhanced Areas	49	448	53
Benefits from Enhanced I/M Requirements*	106	672	76
Total Emission Benefits in Enhanced Areas	155	1,120	129

*Note: DCA/BAR is implementing some of the enhanced program improvements statewide, instead of in enhanced areas only. These include inspections of gas caps for evaporative emission leaks and liquid fuel leak testing. For the purposes of this evaluation, the emission benefits of these improvements in enhanced areas are considered part of the enhanced program.

The overall cost effectiveness of the I/M program for enhanced areas is estimated to be about $5,300 per ton of HC and NOx reduced. This cost effectiveness compares favorably to the typical cost effectiveness values for recently adopted ozone control measures of about $10,000 per ton.

Evaluation of Future Program Benefits

Since 2001, DCA/BAR has implemented several program improvements that will provide additional emission reductions beyond those being achieved in 2002. These include:

- Adding about six million cars to the enhanced program, including the Bay Area (which increases the percent of the fleet subject to the enhanced program from 65 percent to 87 percent);

- Increasing the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet;

- Lowering the NOx inspection standards, or cutpoints, to the levels specified in the State Implementation Plan (SIP); and

- Starting acceleration simulation mode (ASM) dynamometer testing of heavy-duty gasoline powered trucks up to 9,999 pounds gross vehicle weight rating.

In addition to these improvements, DCA/BAR anticipates adding a pressure test of the vehicle's evaporative emissions control system to the program in 2004.

The EMFAC2002 model was used to estimate the future emission benefits projected with all of the improvements mentioned above. The enhanced Smog Check program emission benefits for 2005 and 2010 are shown in Table 1.4. As a result of the aforementioned changes, the projected 2005 and 2010 emission benefits of the enhanced program will be substantially larger than the 2002 enhanced Smog Check emission benefits of 106 tpd HC and 76 tpd NOx. The smaller benefit in 2010 compared to 2005 reflects the fact that the overall 2010 fleet is cleaner due to the presence of more newer, ultra-low emitting vehicles and there are fewer excess emissions to be reduced. For comparison, the overall statewide emissions from gasoline powered vehicles are projected to be about 670 tpd HC and 650 tpd NOx in 2005 and about 480 tpd HC and 450 tpd NOx in 2010.

Table 1.4: Projected Emission Benefits of Enhanced I/M in Future Years with Program Improvements (relative to Basic program)

Year	HC (tpd)	NOx (tpd)
2005	179 (51)*	158 (44)*
2010	146 (44)*	142 (46)*

* Numbers in parentheses refer to the emission benefits resulting from the recently implemented program improvements (adding more vehicles to the enhanced program, increasing the fraction of vehicles directed to Test-Only stations, lowering NOx cutpoints, and ASM testing of heavy-duty gasoline trucks) and the projected benefits from adding a pressure test of the vehicle's evaporative system. These are a subset of the total enhanced emission benefits shown in the table.

The projected emission benefits shown in Table 1.4 are being incorporated into revised SIPs for the parts of California that continue to violate the federal air quality standards. The revised SIPs will reaffirm the State's Smog Check commitment – reflecting the current estimate of the emission reductions being achieved by the program and committing to achieve additional reductions from the improvements that DCA/BAR is continuing to implement.

1.2 Potential Program Improvements

Enhanced Smog Check is one of the most important emission reduction programs in California, alone providing 106 tpd HC and 76 tpd NOx reductions in 2002. With over 500 tpd of additional combined HC and NOx emission reductions needed in the South Coast by 2010 to meet the federal one-hour ozone standard, it is critical that California continue to achieve all the emission reductions feasible from the Smog Check program. Within this context, DCA/BAR and ARB have evaluated the need for a comprehensive redesign of the program as directed in statute and have also evaluated improvements within the framework of the current program design.

Based on this program evaluation, DCA/BAR and ARB have concluded that the current program is working by delivering cost-effective emission reductions. At this time, it would not be appropriate to propose a comprehensive new program to replace the existing Smog Check program. There are promising technologies such as on-board diagnostics (OBD II) and remote sensing that may offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience. Both technologies are the subject of ongoing studies designed to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, DCA/BAR and ARB will report and recommend further program design changes, if appropriate.

Based on the program evaluation, the following potential improvements to the current program have been identified.

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions through other means. DCA/BAR has existing authority to except these vehicles from the biennial inspection, but a change in State law would be required to authorize DCA/BAR to collect a fee from any excepted vehicles and to use those fees toward programs that would offset the foregone emission reductions.

- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles. This would require a change in State law.

- Inspecting older vehicles annually. This would require a change in State law.

- Inspecting high mileage vehicles annually. This would require a change in State law.

- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired.

- Improving the enforcement of Smog Check program requirements by:

  - Authorizing funding to restore enforcement positions at DCA/BAR;
  - Establishing a specialized prosecution unit within the Attorney General's office to focus on Smog Check program cases (which would likely require direction from the Legislature); and
  - Granting statutory authority for DCA/BAR to retain Administrative Law Judges dedicated solely to conducting hearings associated with Smog Check disciplinary actions (which would require a change in State law).

- Adding a smoke test to the Smog Check inspection to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles. This would require a change in State law.

- Excepting newer cars (two years old or less that are still under full warranty) from the requirement for a Smog Check upon change of ownership. This would require a change in State law.

These potential improvements are discussed in detail in Section 4 of this report.

2 Introduction and Background

The federal Clean Air Act requires states with areas that do not meet health-based federal air quality standards to develop SIPs describing how and when the state will attain the standards. The Smog Check program to reduce emissions from motor vehicles is an integral part of California's SIP. The legislation governing the I/M program in California requires DCA/BAR and ARB to periodically report on the effectiveness of the program and recommend possible improvements. This report is intended to meet these requirements.

2.1 History of the I/M Program in California

In the 1977 amendments to the Clean Air Act, Congress required areas that did not attain the ambient air quality standards by 1982 to implement I/M programs to reduce emissions from in-use cars and light-duty trucks. In 1982, the Legislature approved a Smog Check program for the portions of California with the most serious air quality problems, opting for a program based on inspections at privately-owned inspection stations (a "decentralized" program) that would meet the U.S. Environmental Protection Agency (U.S. EPA) targets for HC and CO reductions. DCA/BAR was charged with implementing the Smog Check program. Implementation of the Smog Check program began in 1984.

In the 1982 legislation, the Legislature also created the California I/M Review Committee and charged the Committee with analyzing the effect of the program on vehicle emissions and air quality. The California I/M Review Committee is an advisory group, whose functions pertain primarily to gathering, analyzing, and evaluating data and making recommendations to the Legislature.

In the 1990 amendments to the Clean Air Act, Congress required ozone nonattainment areas classified as serious, severe, or extreme to implement an enhanced I/M program in certain urban areas. In California, these nonattainment areas are the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, and Ventura County. U.S. EPA's regulations implementing the Clean Air Act specify a "model" enhanced program based on centralized stations that do not repair vehicles (also known as centralized "Test-Only" stations) and emissions testing on a transient cycle using a treadmill-like device called a dynamometer. The dynamometer allows emissions of NOx as well as HC and CO to be measured. Because of the extensive network of existing Smog Check stations in California, the Legislature did not initially approve this type of enhanced program. A compromise was reached with U.S. EPA, and in 1994, the Legislature approved a redesign of the program. Implementation of this next generation of California's I/M program, known as the enhanced Smog Check program, started on June 8, 1998.

2.2 Recent I/M Program Developments in California

Since the initial implementation of Smog Check, a number of developments have had significant impacts on the enhanced program. These include several legislative changes enacted in 1997 to make the Smog Check program more consumer-friendly. This legislation exempted pre-1974 vehicles from all program requirements, excepted new vehicles from inspection for their first

four years, allowed waivers for the vehicles that are most costly to repair, repealed annual inspections for certain vehicles, and reduced the repair cost limit for low income motorists.

July 2000 Program Evaluation

In July 2000, ARB released an initial evaluation of the enhanced Smog Check program effectiveness. The report included an evaluation of the program in Summer 1999 (at which time new program elements were still being phased in) and an estimate of the emission reductions being achieved in Summer 2000 when additional program elements had been implemented. Major findings of this evaluation included the following.

- Based on the Summer 1999 evaluation period, the enhanced program was achieving about 36 percent of the combined HC and NOx emission reductions specified in the SIP. Three reasons were identified for the shortfall in program benefits:
  - More rigorous program elements were being phased in over a longer timeframe;
  - The SIP target assumed additional communities and vehicles would be subject to enhanced I/M; and
  - Legislative changes had reduced the effectiveness of the enhanced program.
- Program effectiveness at the time of the report (July 2000) had increased to 60 percent of the HC plus NOx reductions specified in the SIP, due to the implementation of more stringent NOx inspection standards (also known as cutpoints) starting in October 1999.
- The report also identified a set of options for improving the enhanced program.

In an August 17, 2000 letter to U.S. EPA, ARB and DCA/BAR committed to implement several near-term improvements aimed at addressing the shortfall between the SIP target and the actual Smog Check benefits identified in the July 2000 ARB report. Almost all of these program improvements are now in place. The current status of each improvement is summarized below.

- **More Stringent NOx Standards**: NOx cutpoints were tightened on December 6, 2000, to the maximum extent allowable by the regulations in place at the time. New regulations to tighten NOx cutpoints further to the levels specified in the SIP were adopted in June 2002. These tighter cutpoints were introduced in three phases on October 30, 2002, December 4, 2002, and January 8, 2003.
- **Loaded Mode Testing for Heavy-Duty Gasoline-Powered Vehicles:** A regulatory package requiring ASM dynamometer testing of vehicles up to 9,999 pounds gross vehicle weight rating (GVWR)[1] took effect on February 20, 2003, and implementation of this improvement began on May 1, 2003.

[1] ARB's July 2000 evaluation report anticipated the addition of ASM testing of all HDVs up to 14,000 pounds GVWR. However, some vehicles greater than 9,999 pounds GVWR cannot be tested on the current test equipment due to their weight and/or width. DCA/BAR plans to re-examine this issue in the future to determine if any of the heavier vehicles can be ASM tested instead of the current two speed idle (TSI) testing that they receive.

- **Improved Evaporative Emissions Testing:** Liquid fuel leak checks were implemented in September 2001. A pressure test of the vehicle evaporative emissions control system is targeted for implementation in 2004.

- **Direct More Vehicles to Test-Only or Other High-Performance Stations:** At the time of the July 2000 evaluation, 15 percent of the registered vehicles subject to the biennial Smog Check program were being directed to Test-Only stations in the enhanced areas. As of August 2002, DCA/BAR increased the percentage of vehicles directed to Test-Only for biennial inspections to 36 percent of the enhanced area fleet.

- **Remote Sensing:** DCA/BAR and ARB are conducting a remote sensing device (RSD) pilot study to: (1) collect remote sensing readings from approximately one million vehicles; (2) direct up to 5,000 vehicles to Smog Check stations for inspection and repair; and (3) evaluate the most appropriate role of RSD in the enhanced Smog Check program. The results of the pilot study will be used to design an on-going RSD program. In addition, a separate contract has been awarded to a vendor for purchase of 15 RSD units, which DCA/BAR will use to collect additional remote sensing data.

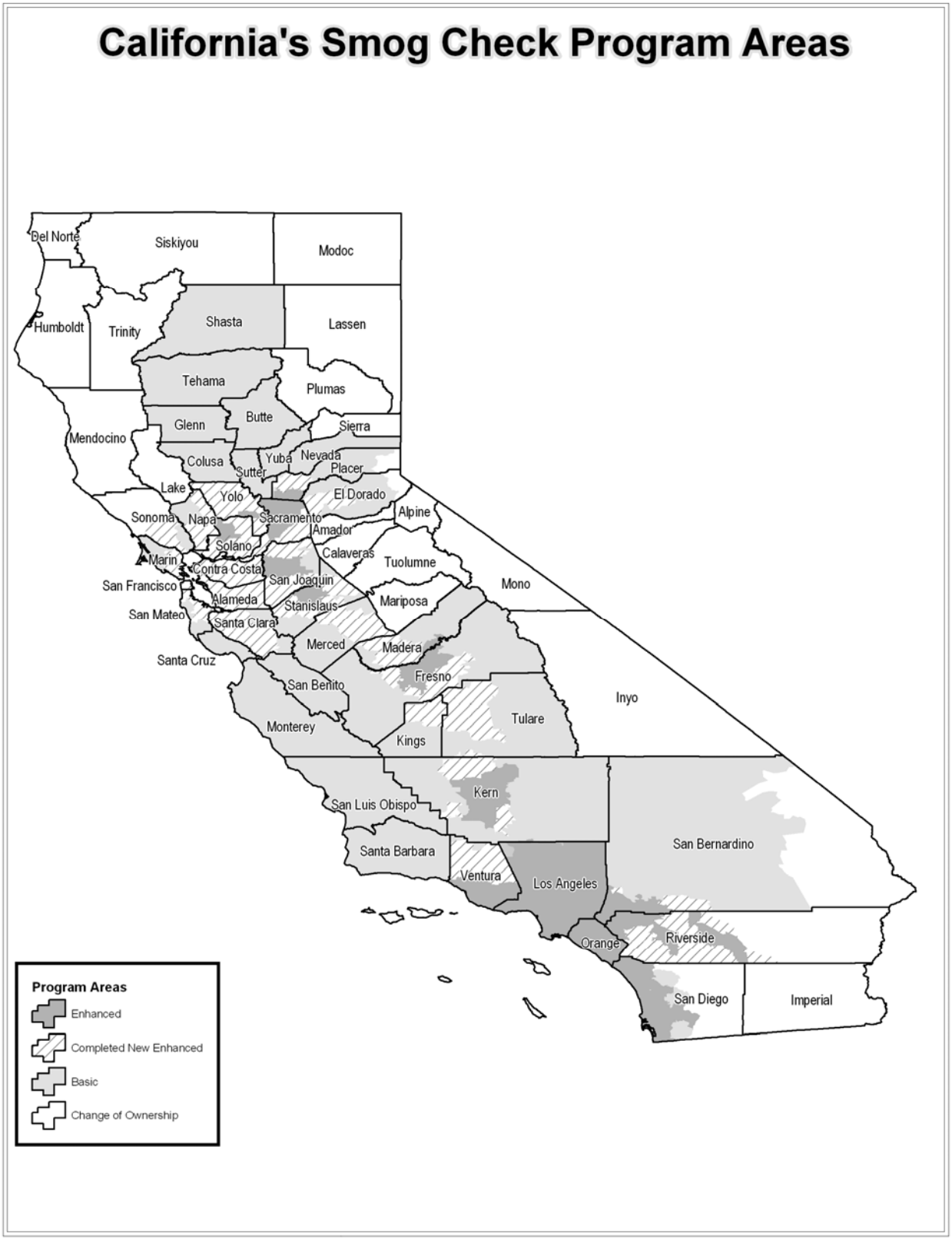
- **Expand Enhanced Areas:** At the time of the July 2000 evaluation, only those vehicles located in urbanized areas of 50,000 or more people were subject to Smog Check in the enhanced I/M areas. Since that time, the enhanced Smog Check program requirements have been extended to additional parts of California as a result of new areas reaching the 50,000 population threshold, local air districts opting in new areas, and Legislative action to include the San Francisco Bay Area. These changes add to the enhanced Smog Check program about six million cars which had previously been subject to the basic I/M requirements, resulting in additional emission reductions. Table 2.1 summarizes the new areas added to the program. Figure 2.1 illustrates the different Smog Check program areas in California. After adding these new areas, about 87 percent of the California fleet will be located in enhanced program areas, 10 percent in basic program areas, and three percent in change of ownership areas.

Table 2.1: Summary of New Areas Added to Enhanced I/M Program

Area (Air District or Air Basin)	Approximate Number of Vehicles Added (estimated May 2002)			Date of Request by Air District	Date of Implementation
	Full Enhanced*	Partial Enhanced*	Total		
San Joaquin Unified APCD	322,000	519,000	841,000	04/19/01	05/01/02
Ventura County APCD	0	35,000	35,000	06/12/01	07/01/02
Sacramento Metro AQMD	0	33,000	33,000	09/27/01	07/01/02
South Coast AQMD	60,000	243,000	303,000	02/01/02	11/01/02
Placer County APCD	0	58,000	58,000	04/11/02	04/01/03
Yolo-Solano AQMD	38,000	33,000	71,000	12/12/01	04/01/03
San Francisco Bay Area	4,800,000	0	4,800,000	09/27/02	10/01/03
El Dorado County APCD	19,000	73,000	92,000	04/16/02	12/01/03

*Full enhanced refers to vehicles subject to all elements of the enhanced program, including potentially being directed to Test-Only stations. Vehicles in partial enhanced areas are not subject to the Test-Only provisions.

Figure 2.1


California's Smog Check Program Areas
Del Norte
Siskiyou
Modoc
Humboldt
Trinity
Shasta
Lassen
Tehama
Plumas
Glenn
Butte
Sierra
Mendocino
Colusa
Yuba
Nevada
Placer
Sutter
Lake
Yolo
El Dorado
Sonoma
Napa
Sacramento
Alpine
Amador
Solano
Calaveras
Marin
Contra Costa
Tuolumne
San Joaquin
San Francisco
Alameda
Mariposa
Mono
San Mateo
Santa Clara
Stanislaus
Merced
Madera
Santa Cruz
Fresno
San Benito
Inyo
Monterey
Tulare
Kings
Kern
San Luis Obispo
San Bernardino
Santa Barbara
Ventura
Los Angeles
Orange
Riverside
San Diego
Imperial
Program Areas
Enhanced
Completed New Enhanced
Basic
Change of Ownership

Additional Recent Program Improvements

DCA/BAR has also implemented several other recent improvements to the Smog Check program, which provide additional motorist convenience and/or result in additional emission reductions, as discussed below.

Gold Shield Program: On July 1, 2003, DCA/BAR reduced the number of station types by implementing a new Gold Shield Program. The Gold Shield stations meet higher standards and perform a wider range of services. This change should make it easier for motorists to get through the Smog Check process.

Special Outreach for Low-Income Motorists: DCA/BAR maintains an ongoing effort to share information with low income and minority consumers concerning programs that may assist them. In addition to a statewide media advertising campaign, DCA/BAR technicians travel to urban communities and participate in local events using a mobile Referee station that became available on September 21, 2002. This vehicle includes a portable dynamometer and a waiting room for consumers, and provides consumers with computer-generated vehicle inspection reports on site. In addition, technicians answer automotive questions, demonstrate how the dynamometer works, and offer information about the Consumer Assistance Program (CAP).

Tijuana Project: DCA/BAR, the State of California, and Mexico have agreed to develop a new vehicle emissions inspection program in the City of Tijuana. Such a program would reduce vehicle emissions and benefit communities on both sides of the border. DCA/BAR has provided consultation, equipment, and training for a pilot Smog Check program. The City of Tijuana inaugurated its first Smog Check inspection station on July 10, 2003.

Tamper Detection and Certification Program (TDC): DCA/BAR and ARB have been training peace officers to identify obvious tampering of the vehicle emission system as an additional aspect of routine traffic stops. If cited, these vehicles must be fully repaired. The TDC pilot program has been ongoing since April 1999. As of February 2003, approximately 5,000 TDC-cited vehicles were tested at State referee sites. Emission reductions from the failing vehicles contribute additional (off-cycle) benefits to the current Smog Check program.

Continuous Testing Pilot Program: DCA/BAR and ARB have been conducting a Continuous Testing Pilot Program to investigate the feasibility of remote monitoring of OBD II status of high mileage fleet vehicles. Under this program, an aftermarket telematics device that sends information on vehicle performance over a wireless network has been installed on a number of high mileage OBD II-compliant vehicles (i.e., taxicabs as well as a few privately-owned vehicles). The device is used to transmit the full OBD II data stream from each vehicle to a website accessible to the agencies. ARB is performing tailpipe emissions tests on some of the vehicles involved in this program, particularly any that report an OBD II problem.

Quality Assurance (QA) Program: DCA/BAR performs twice yearly QA inspections at all enhanced area Smog Check stations to ensure proper testing and/or repairing of vehicles as well as compliance with all applicable laws and regulations. In March 2003, DCA/BAR enhanced its QA Program with an additional element aimed at improving station and technician repair effectiveness. DCA/BAR implemented the Clean Car pilot program to specifically address the diagnostic and repair practices of licensed Test-and-Repair Smog Check stations. Clean Car staff visit selected Smog Check stations and evaluate each station/technicians diagnostic and repair abilities. The staff offers constructive suggestions on ways to more effectively diagnose and repair vehicles in order to attain increased emission reductions. Consumer protection is enhanced by placing emphasis on complete and effective diagnosis and proper invoicing of repairs performed.

2.3 Reporting Requirements

The legislation that established Smog Check also requires DCA/BAR and ARB to periodically assess the effectiveness of the enhanced program to determine whether changes might be warranted. Under Health and Safety Code (H&S) Section 44003(a)(2), the agencies are specifically required to jointly submit a report to the Legislature, based on these specific assessments, which recommends:

> *…any modifications to the enhanced program to improve its operations and lessen its impact on consumers while still achieving the necessary emission reductions to attain air quality standards.*

Section 44003(a)(2) also stipulates that the report is to include a review of any program proposed pursuant to Section 15 of Chapter 803 of the Statutes of 1997. Section 15 contains the following provision:

> *…the State Air Resources Board and the Bureau of Automotive Repair shall design a new proposed program to replace the existing vehicle inspection and maintenance program and submit to the Legislature a report on the new program.*

Section 15 also directs the California I/M Review Committee to review the program proposed by ARB and DCA/BAR and issue its own report to the Legislature.

In addition, Section 44021(e) also requires ARB, in cooperation with DCA/BAR, to submit triennial reports to the California I/M Review Committee that include:

> *…an assessment of the impact on emissions of continuing the exemption from inspection of motor vehicles newer than five years old; a comparison of the actual mass emission reductions being achieved by the enhanced program to those required by the State Implementation Plan; and recommendations to improve the effectiveness and cost-effectiveness of the program, including specific recommendations addressing any discrepancy between emissions achieved and those in the State Implementation Plan.*

This draft report is being submitted to the California I/M Review Committee pursuant to Section 44021(e). ARB and DCA/BAR will work cooperatively with the California I/M Review Committee to obtain comments on this report from the committee and the public. At the conclusion of this public process, ARB and DCA/BAR intend to submit a final report to the Legislature as required by Section 44003(a)(2).

3 Evaluation of the Enhanced I/M Program

In this section, an evaluation of the emission reductions currently being achieved from the enhanced Smog Check program is presented. In addition, the relationship between the Smog Check program and the emission benefits specified in the SIP is presented.

3.1 Emission Reductions from the Current Program

This report focuses on the current effectiveness of the enhanced Smog Check program. This program is in place in the urbanized parts of California with the most challenging air quality problems – the Sacramento Region, San Diego County, San Joaquin Valley, Southeast Desert, South Coast, Ventura County, and, starting in 2003, the San Francisco Bay Area. The enhanced program is just one part of California's overall Smog Check program. Basic Smog Check testing is required biennially in other populated parts of the State, and a basic Smog Check is required upon change of vehicle ownership in rural parts of California. (Figure 2.1 illustrates the parts of California subject to the different Smog Check program elements.) In 2002, about 65 percent of the California fleet was subject to the enhanced program, 32 percent to the basic program, and the remaining three percent to change of ownership testing. To put the assessment of the emission reductions being achieved from the enhanced program in a broader context, Table 3.1 presents the overall statewide emission reductions from the Smog Check program for 2002 based on the EMFAC2002 emissions model. These include the benefits for the entire State – from enhanced, basic, and change of ownership areas. For comparison, the overall emissions from gasoline powered vehicles in 2002 are about 830 tpd HC, 8,570 tpd CO, and 850 tpd NOx.

Table 3.1: Total Statewide I/M Emission Benefits for Calendar Year 2002 (Enhanced + Basic + Change of Ownership Areas) Based on the EMFAC2002 Model

HC (tpd)	CO (tpd)	NOx (tpd)
211	1,360	158

The rest of this section presents an evaluation of the enhanced Smog Check program. The enhanced Smog Check emission benefits discussed below are a subset of the total statewide Smog Check benefits shown in Table 3.1.

Two approaches were used to evaluate the emission reductions from California's enhanced I/M program: (1) an analysis of emissions tests from roadside pull-over programs; and (2) an analysis of the results from ARB's EMFAC2002 motor vehicle emissions model. Each of these approaches has its strengths and weaknesses. A roadside pull-over program provides very good data on the fleet at the time of inspection. However, unless the roadside tests are conducted during a time period when some vehicles are subject to the program and some are not, it is difficult to establish a non-I/M baseline (or an "Old-I/M" baseline in an old program versus new program comparison) with which to compare the results. In addition, forecasting emissions to the future is not possible solely with roadside data. These limitations in the use of roadside data

are overcome with emissions models. Emissions models have the advantage of being able to estimate fleet emissions for different I/M program parameters, and they are capable of forecasting emissions into the future taking into consideration changes to the program that are implemented over time. However, certain inputs to emissions models are sometimes based on limited data, and therefore, the results are subject to some uncertainty.

Roadside Data Evaluation

Random roadside tests are conducted by DCA/BAR with the assistance of the California Highway Patrol (CHP). Although the inspection is not mandatory, the majority of motorists pulled over participate in the program. One of the purposes of the random roadside inspections is to collect exhaust emissions data to evaluate the emissions performance of the in-use motor vehicle fleet and to compare those results to the data collected in the Smog Check program.

The data used in this evaluation were collected over two periods – one representing the emissions from vehicles that had not been subject to the enhanced Smog Check program and the second representing the emissions from vehicles that had been tested under the enhanced Smog Check program. Roadside data collected between November 1998 and October 1999, were originally used in ARB's July 2000 evaluation of the Smog Check program effectiveness. (This will be referred to as the 1999 roadside data.) These roadside tests included vehicles that had never been subject to the ASM dynamometer testing required under the enhanced Smog Check program as well as vehicles that had been through ASM testing. The data collected from the subset of vehicles that had never gone through ASM testing are reused in the current analysis to represent the average fleet emissions in the "before enhanced I/M" case.

Subsequent to the 1999 roadside program, DCA/BAR conducted additional random roadside ASM inspections in enhanced I/M program areas in California between January 2000 and October 2002. Nearly all the vehicles in this data set have been through at least one enhanced I/M test cycle, so it was not possible to estimate the "before enhanced I/M" emissions using these newer data. The average fleet emissions under the "current enhanced I/M" program were estimated using data collected from October 1, 2001, through October 31, 2002. (This will be referred to as the 2002 roadside data.) The percent reduction in fleet average emissions resulting from the enhanced Smog Check program is estimated by comparing the "current enhanced I/M" data to the previously available "before enhanced I/M" data.

The emissions data collected in the roadside test are measured as a concentration – in parts per million or percent by volume depending on the pollutant. For this evaluation, the ASM concentration data collected in the 1999 and 2002 roadside programs were converted to predicted Federal Test Procedure (FTP) emission rates in units of grams per mile (g/mi) using correlation equations that were newly developed for this analysis.[2] (The FTP is the test used for emissions testing and certification of all new passenger cars and light-duty trucks.) This conversion from a

[2] The general approach for developing the correlations closely followed the methodology used in the July 2000 Smog Check evaluation. However, a new data set was used that included additional ASM-FTP test results, particularly for late-model vehicles (i.e., 1996 and newer model year vehicles). In addition, separate conversion equations were developed for pre-1990 and 1990 and newer model year vehicles.

concentration to a g/mi emission rate allows for comparison to the modeled EMFAC2002 emission estimates.

The ASM-to-FTP correlation equations were applied to the roadside ASM test measurements to develop predicted FTP emission rates for each vehicle in the 1999 and 2002 Roadside databases. Mean emission rates were developed for each model year separately for the "1999 Before ASM" sample and the "2002 After ASM" sample. Results from the EMFAC2002 model were then used to forecast model-year specific FTP-based emissions from the "1999 Before ASM" sample to a 2002 basis to account for anticipated emission control system deterioration between 1999 and 2002. In short, this conversion allowed for a more direct comparison of data collected in 1999 with data collected in 2002. In estimating the fleet average emission rate in enhanced areas, an adjustment was made to account for the fact that a small fraction of vehicles in enhanced areas receive a two-speed idle (TSI) test instead of an ASM test because these vehicles are equipped with full-time four wheel drive or traction control that cannot be disabled. Overall, an analysis of the July 2002 Smog Check Vehicle Information Database (VID) data found that about 3.6 percent of enhanced area vehicles actually received a TSI test.

Results of Roadside Data Analysis – The fleet-average FTP-based exhaust emissions results from the roadside data analysis are summarized in Table 3.2.

Table 3.2: Fleet-Average FTP Exhaust Emission Reductions Based on Roadside Data Analysis

I/M Scenario	HC (g/mi)	CO (g/mi)	NOx (g/mi)
Fleet Emission Rate Before ASM Representing the Basic I/M Program (Based on 1999 roadside data)	0.70	8.5	0.62
Fleet Emission Rate After ASM Representing the Enhanced I/M Program (Based on 2002 roadside data)	0.59	7.3	0.56
Percent Reduction Enhanced vs. Basic I/M	**15%**	**14%**	**9%**

The current analysis shows fleet average exhaust emission reductions of 15 percent for HC, 14 percent for CO, and 9 percent for NOx when the enhanced program is compared to the basic program. It should be noted that DCA/BAR has already implemented several program improvements since the most recent roadside testing was completed as mentioned in Section 2, so the program is anticipated to achieve additional benefits beyond those shown in Table 3.1. In addition, it should be noted that the roadside evaluation only addresses exhaust emissions; it does not evaluate the evaporative emissions element of the program.

EMFAC2002 Evaluation

To evaluate the effectiveness of the current enhanced I/M program using an emissions modeling approach, the EMFAC2002 model (version 2.2 released April 23, 2003) was run under two

different I/M scenarios. The first represented the enhanced I/M program in place during 2002. For the second scenario, the enhanced I/M program was replaced with the basic I/M program in place to represent the fleet emissions that would exist if the enhanced program had not been implemented. The difference in emissions between these two scenarios represents the benefits for 2002 of the enhanced I/M program relative to the basic I/M program. These benefits are shown in Table 3.3.

To put the enhanced I/M emission reductions in context, Table 3.3 presents the overall I/M emission reductions for enhanced areas in 2002, separated out into the benefits that would be realized if only the basic program were in place and the additional benefits from the enhanced program. As the table shows, the addition of the enhanced program requirements has more than doubled the Smog Check benefits for these areas. The 106 tpd HC, 672 tpd CO, and 76 tpd NOx of emission reductions from the enhanced program beyond the basic requirements are equivalent to removing two million vehicles from California's roads, making enhanced Smog Check one of the largest emission reduction programs in California. (Note that the total benefits shown in Table 3.3 do not match those in Table 3.1 because Table 3.3 presents the reductions only for the 65 percent of the State subject to enhanced I/M in 2002 while Table 3.1 presents the reductions for the entire State.)

Table 3.3: Total I/M Emission Benefits for Enhanced Areas in Calendar Year 2002 Based on the EMFAC2002 Model

Enhanced Area Benefits	HC (tpd)	CO (tpd)	NOx (tpd)
Benefits from Basic I/M Requirements	49	448	53
Benefits from Enhanced I/M Requirements*	106	672	76
Total Emission Benefit in Enhanced Areas	155	1,120	129

*Note: DCA/BAR is implementing some of the enhanced program improvements statewide, instead of in enhanced areas only. These include inspections of gas caps for evaporative emission leaks and liquid fuel leak testing. For the purposes of this evaluation, the emission benefits of these improvements in enhanced areas are considered part of the enhanced program.

Since 2001, DCA/BAR has implemented several program improvements which will provide additional emission reductions beyond those shown in Table 3.3.

- Between May 2002 and December 2003, about six million vehicles were added to the enhanced program (which increases the percent of the fleet subject to the enhanced program from 65 percent to 87 percent).

- DCA/BAR increased the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet, starting with the August 2002 mailing of December 2002 renewals.

- In January 2003, DCA/BAR lowered the NOx cutpoints to the levels specified in the SIP.

- In May 2003, ASM testing of heavy-duty trucks up to 9,999 pounds gross vehicle weight rating started.

- In addition to these improvements, DCA/BAR anticipates adding a pressure test of the vehicle evaporative emissions control system to the program starting in 2004.

These improvements will result in additional emission benefits beyond those being achieved in 2002. The EMFAC2002 model was used to estimate the future enhanced Smog Check emission benefits projected with these improvements in place. The enhanced Smog Check program emission benefits for 2005 and 2010 are shown in Table 3.4. As a result of the aforementioned changes, the projected 2005 and 2010 emission benefits of the enhanced program will be substantially larger than the 2002 enhanced Smog Check emission benefits of 106 tpd HC and 76 tpd NOx. The smaller benefit in 2010 compared to 2005 reflects the fact that the overall 2010 fleet is cleaner due to the presence of more newer, ultra-low emitting vehicles and there are fewer excess emissions to be reduced. For comparison, the overall statewide emissions from gasoline powered vehicles are projected to be about 670 tpd HC and 650 tpd NOx in 2005 and about 480 tpd HC and 450 tpd NOx in 2010.

Table 3.4: Projected Emission Benefits of Enhanced I/M in Future Years with Program Improvements (relative to Basic program)

Year	HC - tpd (portion of benefits from recent improvements)	NOx - tpd (portion of benefits from recent improvements)
2005	179 (51)*	158 (44)*
2010	146 (44)*	142 (46)*

* Numbers in parentheses refer to the emission benefits resulting from the recently implemented program improvements (adding more vehicles to the enhanced program, increasing the fraction of vehicles directed to Test-Only stations, lowering NOx cutpoints, and ASM testing of heavy-duty gasoline trucks) and the projected benefits from adding a pressure test of the vehicle's evaporative system. These are a subset of the total enhanced emission benefits shown in the table.

Summary of Roadside Versus EMFAC2002 Results

The modeled results from EMFAC2002 can also be presented as an average fleet emission rate to allow for a more direct comparison with the roadside analysis as shown in Table 3.5, which summarizes the FTP-based fleet-average exhaust emissions results from both approaches. There is relatively good agreement between the two different approaches used to estimate percent reductions in exhaust emissions achieved from the enhanced I/M program relative to the basic I/M program. Overall, the fleet exhaust emissions were reduced by 13-15 percent for HC, 14-15 percent for CO and 9-12 percent for NOx when compared to the basic program emission rates. While the fleet-average grams-per-mile exhaust emission rates from these two approaches are somewhat different, this is not unexpected considering that different data sources and methodologies were used in each. The main purpose of the evaluation was to determine the percent by which exhaust emissions were reduced under the enhanced program.

Table 3.5: Exhaust Emission Benefits of Enhanced I/M in Calendar Year 2002 Based on the Roadside Data Analysis and the EMFAC2002 Model (FTP-Based Emission Rates)

Analysis	I/M Scenario	HC (g/mi)	CO (g/mi)	NOx (g/mi)
Roadside Data Analysis	Fleet Emission Rate Before ASM Representing the Basic I/M Program	0.70	8.5	0.62
	Fleet Emission Rate After ASM Representing the Enhanced I/M Program	0.59	7.3	0.56
	Percent Reduction	**15%**	**14%**	**9%**
EMFAC2002 Analysis	Fleet Emission Rate Under Basic I/M Program	0.83	9.5	0.75
	Fleet Emission Rate Under Enhanced I/M Program	0.72	8.1	0.66
	Percent Reduction	**13%**	**15%**	**12%**

3.2 State Implementation Plan Targets

Background on the 1994 Ozone SIP

In November 1994, California submitted to U.S. EPA a comprehensive SIP, detailing how six areas of the State – San Diego, the San Joaquin Valley, Ventura, Sacramento, the Southeast Desert, and the South Coast – would attain the one-hour federal ozone standard. The Smog Check program was a critical element of the 1994 SIP along with other local, State, and federal measures for motor vehicles, stationary sources, and area sources.

When the 1994 SIP was developed, ARB made its best estimate of emission benefits expected from the enhanced Smog Check program and from other State control measures. At that time, an enhanced Smog Check program had not been implemented anywhere in the country, so there were limited data upon which to estimate the potential emission benefits.

As the 1994 SIP has been implemented over the last nine years, ARB has adjusted its expectations based on actual evolution of its control program. Most of the measures specified in the 1994 SIP have been adopted. Some measures have provided more reductions than specified in the SIP, while others have provided less. ARB has also adopted several measures that were not envisioned when the SIP was developed in 1994. For example, measures which called for the early retirement of motor vehicles did not provide the emission reductions originally envisioned, as funding needed for such programs didn't materialize. On the other hand, the Low Emission Vehicle II program provided much greater emission reductions than anticipated. In addition, measures not originally included in the SIP, such as new emission standards for heavy-duty trucks starting in 2007, will provide significant emission reductions.

In the case of Smog Check, the enhanced program is achieving significant emission reductions needed to meet the air quality standards (106 tpd HC, 76 tpd NOx, and 672 tpd CO in Summer

2002). However, the implementation of the program proceeded more slowly than specified in the SIP. Inspection cutpoints were tightened to the levels specified in the SIP incrementally in recognition of the impact of the Smog Check program directly on individual consumers. Some elements of the program have been especially technically challenging to implement, such as more comprehensive evaporative emissions testing. The low pressure evaporative test is not yet in place, but DCA/BAR envisions introducing that program improvement in 2004. While some program elements have taken longer to implement than expected at the time the 1994 SIP was developed, other actions such as the decisions by local air districts to add vehicles to the enhanced program are providing additional emission benefits.

In addition to adjusting the expectations regarding the implementation of its control program, ARB has updated its technical tools – greatly improving the accuracy of its mobile source emissions inventory since the 1994 SIP was developed. More extensive real-world testing of vehicles and greater numbers of older vehicles on the road result in higher emissions than estimated in prior SIPs. The emissions inventory used in the 1994 SIP no longer represents our best understanding of real world emissions. The current Smog Check emission reduction estimates cannot be directly compared to the 1994 SIP targets because the updated estimate of motor vehicle emissions is so much higher. To be meaningful in the context of this updated understanding of the emissions that contribute to California's air quality problems, the expectations for the State's emissions control program must be updated to reflect the new inventory.

Updating the SIP and the Smog Check Commitment

ARB and the local air districts are undertaking comprehensive SIP revisions to reflect the updated emissions information and the updated understanding of the benefits of the State's control program. Recent technical work in the South Coast and San Joaquin Valley show that both regions need further emission reductions to meet the existing federal air quality standards by 2010. In addition, changes in federal policy require that these SIPs be updated to reflect new emissions estimates and controls for motor vehicles in order to preserve California's ability to secure federal transportation funding. With virtually all of the State's 1994 SIP measures already adopted and being implemented, ARB must develop new measures to continue progress. The updated SIPs identify a series of new State commitments to achieve the next increment of progress toward the federal one-hour ozone and PM10 standards. The San Joaquin Valley's updated PM10 SIP was approved by ARB in June 2003, and the South Coast's updated SIP was approved by ARB in October 2003. Updated ozone SIPs for the San Joaquin Valley, Sacramento, and Ventura are expected in the next year or two.

The revised SIPs reaffirm the State's Smog Check commitment – reflecting the current estimate of the emission reductions being achieved from the program and committing to achieve additional reductions from the improvements that DCA/BAR is continuing to implement.

- The baseline emission inventories for the new SIPs reflect the 106 tpd HC, 76 tpd NOx, and 672 tpd CO being achieved under the current enhanced Smog Check program in summer 2002. The inventories also project these emission benefits into future years. By reflecting these emission reductions in the baseline emission inventory, these reductions

become an enforceable part of the SIP. Any future changes that would result in a loss of benefits would need to be made up in order to keep the SIP whole.

- The new SIPs also include quantified emission reduction commitments to reflect ongoing and upcoming program improvements that have not yet been incorporated into the emission inventory. These include:

  - Increasing the percentage of vehicles directed to Test-Only for their biennial inspections to 36 percent of the enhanced area fleet. DCA/BAR implemented this improvement in 2002, but the benefits have not yet been reflected in the baseline emission inventory.

  - Loaded mode testing for heavy-duty gasoline-powered vehicles up to 9,999 pounds gross vehicle weight rating. DCA/BAR began implementing this improvement on May 1, 2003, but the benefits have not yet been reflected in the baseline emission inventory.

  - Improved Evaporative Emissions Testing. A pressure test of the vehicle evaporative emissions control system is targeted for implementation in 2004.

  These program improvements will be implemented in all enhanced I/M areas. With these improvements, the overall enhanced Smog Check benefit is estimated to be 179 tpd HC and 158 tpd NOx in 2005 and 146 tpd HC and 142 tpd NOx in 2010.

Further Reductions Still Needed

While the Smog Check improvements listed above are being incorporated into the updated SIPs, additional emission reductions are needed from all sources to meet California's air quality goals. The 2003 South Coast SIP contains new, near-term State and local commitments designed to achieve over 250 tpd of HC and NOx reductions (including the Smog Check improvements), as well as a long-term commitment to achieve over 300 tpd of additional HC and NOx reductions by 2010. For the San Joaquin Valley to meet the federal one-hour ozone standards, preliminary estimates indicate approximately a 30 percent overall reduction in HC and NOx emissions will be needed. Achieving these reductions by 2010 will pose a significant challenge. Meeting the federal eight-hour ozone, the federal PM2.5 standards, and the State air quality standards will require even greater emission reductions. State, federal, and local air quality control agencies will need to continue pursuing cost-effective and feasible emission reductions from all sources.

Despite the significant emission reductions from motor vehicles that have occurred in recent years, emissions from passenger cars, pickup trucks, and medium-duty vehicles alone will still account for over 20 percent of the HC and NOx emissions in 2010. Most of these motor vehicle emissions come from the older part of the fleet as new cars become cleaner and cleaner. In 2010, it is projected that those cars 13 years and older (pre-1998 model years) will account for about 75 percent of the HC and NOx emissions from the light-duty fleet despite accounting for only about 25 percent of the miles traveled. To meet California's air quality goals, additional emission reductions are needed from the existing fleet – particularly these older vehicles.

Additional Smog Check program improvements beyond those being committed to in the upcoming SIP may prove to be the most cost-effective way to achieve these needed emission reductions. Section 4 of this report identifies potential improvements to the Smog Check program that could provide some of these reductions. Many of these improvements would require changes to State law.

3.3 Impact of Five/Six Model Year Exception

Assembly Bill (AB) 2637, signed by Governor Davis in September 2002, establishes an enhanced I/M program in the San Francisco Bay Area Air Basin. As part of the bill, the current four-year Smog Check exception for new motor vehicles was extended statewide to six years, with the goal of minimizing the burden of the program on vehicles less likely to fail an inspection. The extension of the biennial exception was to take effect on January 1, 2004, unless ARB determined that the change would prohibit the State from meeting its SIP commitments or the requirements of the federal Clean Air Act.

As directed by AB 2637, ARB analyzed the potential emissions impact of extending the current four year Smog Check exception for new motor vehicles to five or six years. Both exhaust and evaporative emissions were considered in the evaluation. The analysis focused on those areas of California with enhanced I/M ASM dynamometer testing already in place or expected by January 2004 and thus includes the San Francisco Bay Area. The primary source of data was approximately 13,000 emission tests collected statewide during random pull-over inspections conducted by DCA/BAR between 2000 and 2002. An additional 2,000 emission tests performed at the ARB's Haagen-Smit Laboratory were also used in the analysis. Analysis of data obtained from Arizona and Wisconsin's inspection programs confirmed the exhaust failure rates observed in California's roadside data. Data from Arizona's evaporative pressure tests were used directly in calculating evaporative emission rates because an evaporative pressure test will not be implemented in California until 2004. For 1995 and newer vehicles subject to the enhanced evaporative test procedures, pre-inspection failure rates were based on an analysis of the OBD II data collected during a DCA/BAR roadside study in Fall 2002.

Emission rates from all tests were used to create an overall baseline fleet emission value. By identifying those five and six year old vehicles that would fail an I/M inspection, fleet emission rates with and without five and/or six year old vehicles excepted from biennial inspections were calculated. The difference in fleet emission rates as a percentage increase was applied to the baseline tons per day emission results calculated by the EMFAC2002 model to determine the statewide loss of emission reductions from excepting five and six year old vehicles from inspections. The analysis methodology is similar to the approach used in ARB's July 2000 evaluation of the Smog Check program. The analysis assumes that the excepted vehicles would still be subject to a change of ownership inspection. A 17 percent annual change of ownership rate was used in the analysis.

The results indicate that extending the new vehicle exception for an additional one or two more years would increase vehicle emissions in enhanced I/M areas as shown in Table 3.6. Excepting both five and six year old vehicles from the biennial inspection requirement would increase emissions by about four tpd of HC plus NOx in 2005. Excepting only five year old vehicles

would increase 2005 calendar year emissions by nearly two tpd in enhanced I/M areas. The emission increases from additional Smog Check exceptions would be lower in 2010 because the overall 2010 fleet is cleaner. However, a five or six year exception from the biennial inspection is still estimated to increase ozone-forming emissions by one to three tpd, respectively.

Table 3.6: Emissions Impact from Five and Six Model Year Exception

	Enhanced Area Emissions (tpd)					
	HC			**CO**	**NOx**	**HC+NOx**
	Exhaust	Evap.	Total			
2005 Baseline *	259	242	501	5,013	507	1,008
Increase: 5 year exception	0.10	0.59	0.69	4.95	1.08	**1.77**
Increase: 6 year exception	0.51	1.19	1.70	13.12	2.01	**3.71**
2010 Baseline *	167	194	361	3,507	344	705
Increase: 5 year exception	0.07	0.47	0.54	3.44	0.73	**1.27**
Increase: 6 year exception	0.33	0.95	1.28	9.18	1.36	**2.64**

*Baseline – Light-duty vehicles subject to Smog Check

The magnitude of the increases would present a significant barrier towards achievement of California's air quality commitments. Consequently, at its April 24, 2003 Board meeting, ARB made a finding that the emissions impact would adversely affect California's plan to meet federal air quality standards and adopted a resolution which concludes that the new vehicle exception not be extended to model years five and six in nonattainment areas at this time.

Staff believes that opportunities may exist for more targeted newer vehicle exceptions to the biennial inspection requirement by focusing on vehicles determined to be far less likely to benefit from an initial inspection after four years in comparison to the overall five and six year old fleet. For example, it may be possible to except certain groups of vehicles (such as Partial Zero Emission Vehicles) whose emission characteristics and extended warranty period suggests few vehicles would fail any inspection. It may also be possible to except individual vehicles, or groups of vehicles, based on roadside measurements or based on historical records collected by DCA/BAR. Studies are underway to establish the effectiveness of these approaches. In Section 4 of this report, a program change is recommended for excepting a subset of the five and six year old vehicles that have the greatest likelihood of passing their Smog Check inspections (see Section 4.2).

3.4 Cost Effectiveness of Current Program

The final portion of the analysis involved estimating the current cost effectiveness of California's Smog Check program in enhanced areas. The estimated total Smog Check emission benefits for enhanced areas in 2002 is 155 tpd HC and 129 tpd NOx as shown in Table 3.3. Over a full two-

year Smog Check cycle, this equates to 207,000 tons of HC and NOx reduced. The initial test failure rate, and the average ASM inspection cost, and average repair cost used to estimate the cost effectiveness are based on data from the 2002 DCA/BAR Executive Summary report. The cost effectiveness shown in Table 3.7 is calculated by dividing the total enhanced program costs by the combined HC and NOx benefits.

Table 3.7: Cost Effectiveness Estimate for Smog Check Program in Enhanced Areas Calendar Year 2002

Enhanced area initial test failure rate (%)	15.6%
Total average ASM inspection cost - includes $8.25 cert fee ($/Test)	$54
Average enhanced repair cost ($/Vehicle)	$143
Average test cost per vehicle ($)	$76
Number of vehicles subject to I/M	14,421,542
Total cost per I/M cycle ($)	$1,102,037,707
Combined HC and NOx benefits (tons/ I/M cycle)	207,273
Cost effectiveness ($/Ton)	**$5,317**

The cost effectiveness of about $5,300 per ton of HC and NOx reduced is favorable; typical cost effectiveness values for recently adopted ozone control measures are $10,000 per ton.

4 Opportunities for Enhanced Smog Check Improvement

4.1 Introduction

Pursuant to the reporting requirements discussed in Section 2.3, DCA/BAR and ARB evaluated the existing enhanced Smog Check program to determine whether changes might be warranted to improve its operations and lessen its impact on consumers.

As a result of the evaluation, staff identified eight potential near-term program changes to the enhanced Smog Check program that would achieve additional emission reductions and/or improve program operations. Sections 4.2 through 4.8 present background information and evaluation details for these program elements. These eight elements would require legislative action or budgetary approval as the first step towards implementation. These potential changes are:

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions (Section 4.2);
- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles (Section 4.3);
- Inspecting older vehicles annually (Section 4.4);
- Inspecting high mileage vehicles annually (Section 4.5);
- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired (Section 4.6);
- Improving station performance through better enforcement (Section 4.6);
- Adding a smoke inspection test to the Smog Check program to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles (Section 4.7); and
- Excepting newer vehicles from the change of ownership Smog Check test (Section 4.8).

In addition to these recommendations, staff examined several other potential improvements that could increase emission reductions and/or make the program more convenient for motorists. These include adding motorcycles and diesel-fueled vehicles (passenger, light-duty trucks and medium-duty trucks) to the program, improving compliance with vehicle registration requirements, and restarting the vehicle retirement program. Initial evaluation suggests that these improvements may have merit. However, additional study is needed to evaluate emission reduction benefits, ease of implementation, impact on motorists, and cost effectiveness before recommendations for program changes could be made. These potential program improvements are discussed further in Section 4.9.

Section 4.10 discusses the potential for a future, more comprehensive program redesign based on the incorporation of OBD II and remote sensing. These technologies offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience of Smog Check. Both are the subject of ongoing studies to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, further program changes may be proposed.

4.1.1 Consumer/Industry Impact

This report makes a series of recommendations resulting from science-based estimates of emission reductions that would result from certain changes within the Smog Check program. Before adoption, each of the recommendations should be evaluated for their impact on private and commercial vehicle owners as well as the automotive test and repair industry.

Implementation of these recommendations may impose additional requirements on some vehicle owners and reduce requirements on others. In those cases where less frequent testing is required, vehicle owner satisfaction is anticipated to result due to the decreased cost of testing. Based on the report's findings, this can be achieved with little or no detrimental effect to the environment. In those cases where the requirements would be greater, the benefit may not readily be apparent to the vehicle owner. However, vehicles that operate efficiently pollute less and realize better fuel economy.

Nevertheless, a thorough analysis of the social and economic impacts of the recommendations should be undertaken in evaluating whether, and in what timeframe, they should be implemented. This is because they will bear a cost to some segments of the economy, will reduce costs to other segments and will increase business opportunities for a third segment, the Smog Check station industry.

This is best addressed through the California I/M Review Committee's public review process to evaluate those factors.

4.2 Clean Screen for Five and Six Year Old Vehicles

Background: Currently, the newest four model year vehicles are excepted from their biennial Smog Check inspection. AB 2637 extended the exception for newer vehicles by two more model years, unless ARB determined the extension would adversely affect California's ability to meet its SIP commitments and Federal Clean Air Act requirements. At its Board meetings in April and May 2003, ARB determined that it would be necessary to exclude all enhanced areas from the five/six year exception as well as select basic areas (where federal air quality standards have not yet been attained). ARB concluded that excepting the five and six year old vehicles in enhanced areas would result in emission losses of approximately four tons per day of HC and NOx by 2005. (See Section 3.3 for more details on this analysis.) In order to minimize the inconvenience to motorists throughout the State, staff believes that opportunities may exist for more targeted newer vehicle exceptions focusing on five and six year old vehicles expected to pass their initial inspection.

In 2004, DCA/BAR intends to use a low emitter profile (LEP) model as a "clean screen tool" to identify vehicles that could be excepted from their biennial inspection for their first six years because they are predicted to pass. Ideally, if the LEP worked perfectly, all vehicles excepted would have passed their Smog Check inspections, and there would be no foregone emission reductions resulting from the exceptions. However, in practice, some small fraction of vehicles excepted by the LEP would have failed their Smog Check inspections because there are always outliers even among engine families that are identified as clean. Any resulting emissions

increase would need to be mitigated through other means to ensure that a clean screen program does not interfere with California's plan to meet the federal air quality standards. These could include early vehicle retirement, engine replacement projects such as those funded through the Carl Moyer Program, or other air quality improvement projects such as those funded by air districts using motor vehicle registration fees.

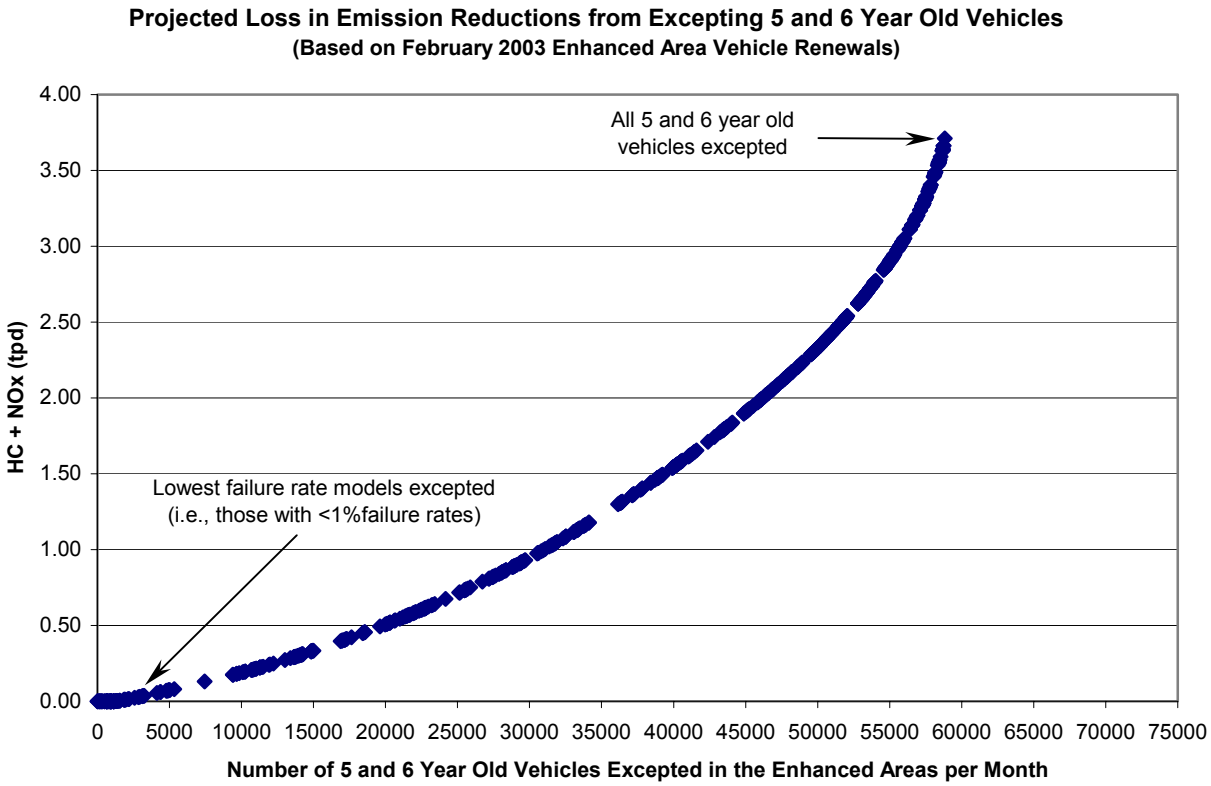
Evaluation: In May 2003, DCA/BAR began processing data for development of a LEP model. The model will be very similar to early versions of the High Emitter Profile (HEP) currently used to direct vehicles to Test-Only stations in the enhanced areas of California. However, instead of ranking vehicles according to the probability that they will have high excess emissions, as the HEP does, it would rank vehicles according to the probability that they will have low emissions and will pass their Smog Check inspection.

Both generic and specific data on the fleet can be used to predict whether a vehicle will be a low emitter or not. Generic information would include evaluating vehicle emissions on the basis of past performance of similar vehicles. Previous analysis has shown the historical failure rate on an engine family specific basis to be a strong predictor of vehicle emissions. Specific data includes previous Smog Check history on an individual vehicle (if available).

Recently, DCA/BAR examined historical Smog Check inspection records to estimate generic failure rates for the vehicles subject to California's Smog Check program. Predicted engine family specific ASM inspection failure rates for five and six year old cars range from zero percent to 21 percent based on Smog Check data from 2002. Models with very low failure rates are candidates for the LEP while models with failure rates of 10 or 20 percent would not be candidates to be clean screened.

Figure 4.1 shows the projected loss in emission reductions (HC and NOx) that is expected to occur in 2005 when specified numbers of five and six year old vehicles are excepted from the biennial inspection requirement under a LEP scenario in which the cleanest vehicles are excepted first. For example, if 20,000 vehicles (about one-third of the five and six year old fleet) were excepted each month in the enhanced areas for one biennial cycle using a LEP, the emissions impact is expected to be about 0.5 tpd (HC and NOx) in 2005. If 32,000 vehicles (about 54 percent of five and six year old vehicles) were excepted each month, emissions would increase by one tpd (HC and NOx) in 2005. For comparison, if all five and six year old vehicles were excepted, the emissions impact would be about four tpd.

Figure 4.1



A simple LEP model could be developed using a ranking system based on this generic vehicle data. Over time, a more detailed statistical model could be designed using all available data. Once the model has been developed and its performance evaluated, the percent of five and six year old vehicles that can be clean-screened with the least impact on anticipated emission reductions can be determined.

To summarize, the capability exists to identify vehicles within the five and six year old vehicle model year group with the lowest failure rates through a LEP. DCA/BAR could design a voluntary program that uses a LEP to except five and six year old vehicles predicted to pass their Smog Check inspection. Owners of five and six year old vehicles identified as "clean" by a LEP could be offered the opportunity to participate in a clean screen program in which they pay a fee in lieu of having a Smog Check. Presumably, the fee would be less than the cost of a Smog Check, so the consumers would benefit by saving both time and money. Because the LEP would not work perfectly in practice, a small fraction of vehicles would be misidentified as clean. The fees collected from consumers opting out of their Smog Check would be used to mitigate any loss in emission benefits through other means. A change in State law would be required to authorize DCA/BAR to collect such a fee.

Recommendation: Develop a method for excepting the portion of five and six year old vehicles projected to have the lowest emissions and thus the greatest likelihood of passing the Smog Check test. Inevitably, the method will except some vehicles with high emissions that will not be repaired. To avoid a loss of emission reductions, staff recommends that DCA/BAR be

granted the authority to charge a small fee to those owners who choose to have their vehicles excepted from their biennial inspection. The fee would be used to fund other programs, such as vehicle scrappage or the Carl Moyer program, that achieve emission reductions.

> **Recommendation #1** – Design a program to offer motorists whose five and six year old vehicles are predicted to pass the biennial Smog Check, based on a LEP, the opportunity to participate in a clean screen program. DCA/BAR should be authorized to charge owners of any excepted vehicles a fee and to use the funds generated to fully offset any foregone emission reductions. This would require a change in State law.

Consumer/Industry Impacts: Vehicle owners participating in the voluntary "clean screen" program would save both time and money by paying a fee in lieu of their Smog Check, presuming the fee paid would be less than the cost of a Smog Check inspection. Given the time and cost savings as well as the voluntary nature of the program, consumers are expected to support this recommendation. However, this change could potentially result in a loss in revenue for Smog Check station owners. If, for example, one-third of the five and six year old fleet were excepted in the enhanced areas, there would be 240,000 fewer inspections conducted annually. This equates to about three percent of the 7.2 million inspections conducted annually in enhanced areas based on DCA/BAR data for 2002. The corresponding annual loss in revenue to station owners would be about $11 million assuming an average test cost of about $46 based on 2002 DCA/BAR data. (This analysis assumes only a loss in test revenue, but no loss in repair revenue since only vehicles expected to pass their inspection would be offered the "clean screen" alternative.)

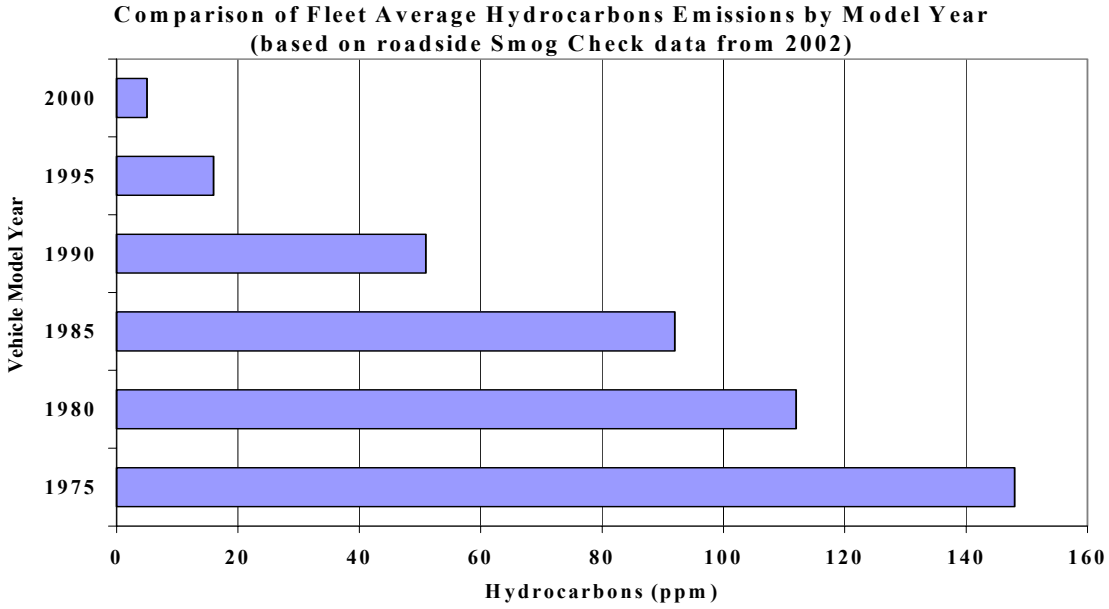
4.3 Eliminate the Existing 30-Year Rolling Exemption

Background: In 1997, the Legislature modified the Smog Check program to exempt pre-1974 vehicles from the program. Beginning in January 2003, this legislation exempts motor vehicles 30 or more model years old from the Smog Check program. The range of model years exempted shifts annually. Hence, this has become known as the "30-year rolling exemption." (In 2003, 1975 to 1999 model year vehicles were subject to testing pursuant to the biennial Smog Check program, and in 2004, 1976 to 2000 model year vehicles are subject to the program.) Prior to the 1997 legislation, only pre-1966 model years had been exempt from the program.

Because older vehicles contribute a disproportionate amount of emissions despite their relatively low numbers and use, excluding older vehicles from the program reduces the effectiveness of the Smog Check program. Figure 4.2 shows the relative HC emissions of vehicles by model year, based on roadside Smog Check data. An average 1975 model year car emits about 30 times more HC than a 2000 model year car. Pre-1976 model year cars account for 19 percent of the HC and eight percent of the NOx emissions from the light-duty fleet in 2004 despite accounting for only about 2.4 percent of the vehicle population and 1.2 percent of the miles traveled (based on the EMFAC2002 model). A similar distribution of emissions is projected in future years. For example, in 2010, pre-1982 cars (i.e., those exempt in 2010) are projected to account for 22 percent of the HC and 11 percent of the NOx emissions from the light-duty fleet despite

accounting for only about 2.6 percent of the vehicle population and 1.3 percent of the miles traveled.

Figure 4.2



The impact of exempting only the pre-1976 vehicles will lessen over time due to vehicle retirement. However, the 30-year rolling exemption essentially institutionalizes the loss in emission reductions.

Evaluation: There are two approaches to "recover" the lost emission benefits, each of which would require a statutory change by the Legislature: (1) repealing the rolling exemption and replacing it with a pre-1976 exemption so that no additional model years will be exempt, or (2) repealing the rolling exemption and replacing it with a pre-1966 exemption as had existed prior to the most recent legislative change. Staff estimated the 2010 emission benefits in enhanced areas for each of these options. (2010 was selected because it is the South Coast's attainment date for the federal one-hour ozone standard, a critical milestone for achieving additional emission reductions.)

Table 4.1 presents the estimated 2010 emission benefit of eliminating the current 30-year rolling exemption and replacing it with an exemption for pre-1976 model years. If this change were implemented, approximately 340,000 additional model year 1976-1981 vehicles would remain in the program in 2010 compared to current provisions which would only require Smog Checks for 1982 and newer model year vehicles.

Table 4.1: 2010 Emission Benefits for Enhanced Areas from Replacing 30-Year Rolling Exemption with a Pre-1976 Model Year Exemption (Keeping Model Years 1976-1981 in the Program in 2010)

HC (tpd)	NOx (tpd)
2.7	3.0

The cost effectiveness of this program improvement is estimated to be a favorable $7,900 per ton. This cost effectiveness is calculated by dividing the program improvement costs by the combined HC and NOx benefits using the same calculation method, and ASM inspection and repair costs, as the analysis of the current enhanced program presented in Section 3.4. This analysis assumes a statewide initial test failure rate of about 30 percent, which is based on data for model years 1976 through 1981 from the Fiscal Year (FY) 2001 DCA/BAR Executive Summary report.

Table 4.2 shows the estimated 2010 emission benefits of including 1966 to 1975 model year vehicles in the enhanced Smog Check program as originally envisioned in the 1994 SIP. The size of the 1966-1975 model year fleet in enhanced areas is estimated to be about 470,000 vehicles in 2003, dropping to about 240,000 vehicles in 2010 due to fleet turnover.

Table 4.2: 2010 Emission Benefits for Enhanced Areas from Adding 1966-1975 Model Year Vehicles to the Program

HC (tpd)	NOx (tpd)
7.6	3.3

Because the pre-1976 vehicles have already been exempted, reintroduction of these vehicles into the biennial inspection cycle might result in relatively high failure rates and associated high repair costs. In addition, consumers owning pre-1976 vehicles might feel like a new burden is being imposed on them and strongly oppose the change. On the other hand, repeal of the rolling exemption should not generate the same level of opposition because the vehicles that would be affected are currently included in the biennial inspection cycle. Because these vehicles have not been exempted yet, repealing the exemption would not impose a new requirement upon these vehicle owners.

Recommendation: Replace the current 30-year rolling exemption with a pre-1976 model year exemption. This would require a change in State law. Because 1976 models are not exempt under current law until 2005, no new requirements would be imposed on vehicle owners that they are not already facing. The California I/M Review Committee made the same recommendation at its May 29, 2003 meeting, and ARB had previously identified this as a potential program improvement in its July 2000 report evaluating the enhanced Smog Check program.

At this time, staff is not recommending that pre-1976 vehicles be reintroduced back into the program because this change might result in high failure rates and high repair costs and may be strongly opposed by consumers. However, such a change would result in significant emission reductions as shown in Table 4.2. With the daunting need for emission reductions to meet California's health-based air quality standards, adding these vehicles to the program could be considered at some point in the future. The use of remote sensing to identify the highest emitting pre-1976 vehicles may provide an alternative method of reducing some of these emissions. ARB and DCA/BAR will provide an assessment and recommendation upon completion of the joint remote sensing study currently being conducted.

> **Recommendation #2** – Eliminate the 30-year rolling exemption and replace with an exemption for pre-1976 model year vehicles. This would require a change in State law.

Consumer/Industry Impacts: This change would affect the owners of older vehicles that are currently in the Smog Check program but would become exempt in future years under the current provisions of State law. No previously exempted vehicles would be reintroduced. By 2010, 340,000 additional model year 1976-1981 vehicles would remain in the Smog Check program compared to the current 30-year rolling exemption if this change went into effect in 2005. This would mean about 170,000 additional Smog Check inspections in 2010 (since inspections are required biennially). Assuming an average Smog Check cost of $46 for the inspection (based on 2002 DCA/BAR Executive Summary report), an average repair cost of $143 (based on 2002 DCA/BAR Executive Summary report), and a failure rate of about 30 percent for these older vehicles, consumers would continue to pay for an estimated $7.8 million in testing and approximately $7.5 million for repairs to these vehicles in 2010. (Please note, this preliminary analysis relies on 2002 cost estimates. Projected test and repair costs for 2010 have not been estimated.) Some motorists would qualify for financial assistance through the Consumer Assistance Program thus lowering the estimated repair costs. Benefits for consumers whose vehicles receive Smog Check repairs include better running vehicles and improved fuel economy.

While this change would potentially subject consumers to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the 2010 estimates cited above, the industry would potentially realize additional test and repair revenues of $15 million.

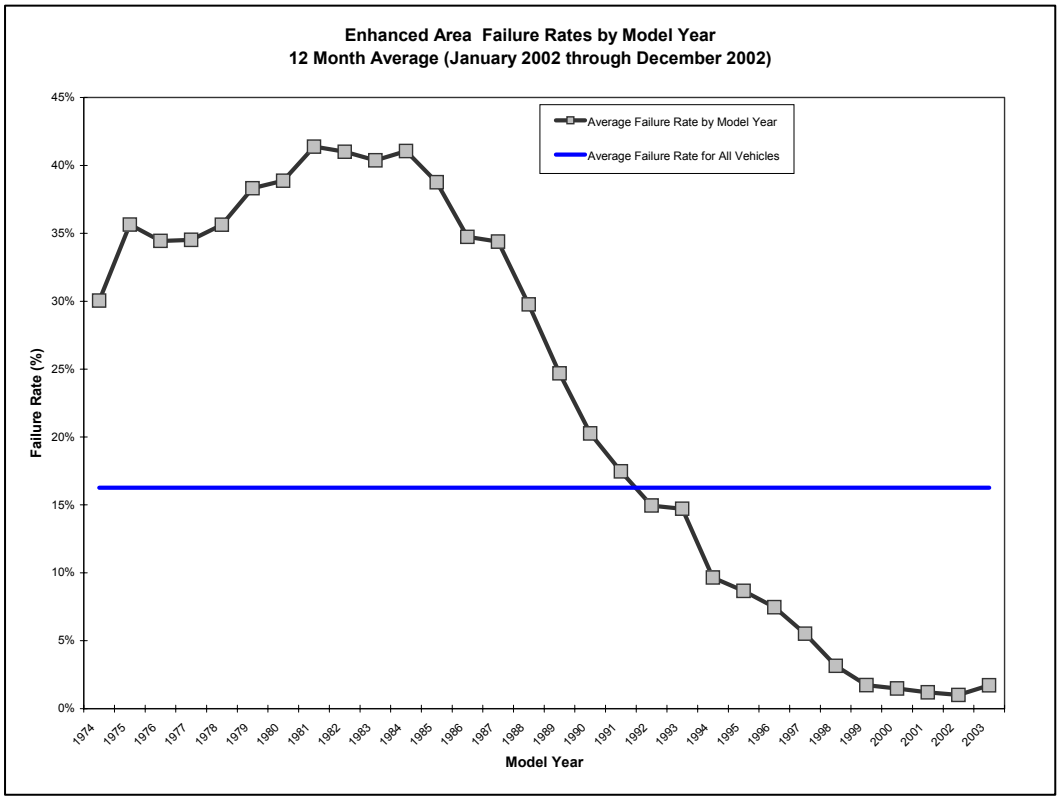
4.4 More Frequent Inspections for Older Vehicles

Background: Currently, California vehicles are required to undergo Smog Check testing every two years or upon change of ownership of the vehicle. Many I/M programs nationally inspect vehicles once a year; some vary the test cycle by vehicle age and emissions technology. If older vehicles that have the greatest likelihood of failing were inspected annually instead of biennially, additional emission benefits could be realized by shortening the time that vehicles are emitting excess emissions prior to being repaired.

The key to successfully adding an annual testing component to the enhanced Smog Check program would be to focus the annual inspections on the small subset of the fleet that has the greatest chance of failing. This would allow additional emission reductions to be achieved while subjecting a minimum number of consumers to the inconvenience of annual testing.

Evaluation: As vehicles age and deteriorate, they tend to fail their Smog Check inspections more frequently. This point is demonstrated in Figure 4.3 which shows average ASM test failure rates by model year based on Smog Check program data collected during calendar year 2002. While the overall failure rate averages about 16 percent, the failure rate rises sharply with vehicle age. At 11 or 12 years of age (model years 1991 and 1992 in Figure 4.3), vehicles fail at a rate that is about equal to the overall fleet failure rate. However, by the time vehicles reach 15 years of age (model year 1988 in Figure 4.3), the failure rate rises to 30 percent, about twice the overall fleet failure rate. The failure rate rises as high as 40 percent for vehicles from the early-1980s. Additional emission reductions would be achieved if the vehicles with higher failure rates are subject to more frequent inspection and repair.

Figure 4.3



To illustrate the potential emission benefits of requiring annual testing for older vehicles, staff estimated the emission benefits of requiring annual instead of biennial testing for vehicles over 15 years old. Fifteen years of age was selected as an example because this is the point at which vehicles start failing at a rate twice the fleet average. In addition, the vehicles older than 15 years accounted for less than 25 percent of the Smog Check tests performed in the past year. Thus, over 75 percent of vehicle owners would be unaffected by the change. If DCA/BAR were to implement an annual testing program for older cars, the exact vehicle age at which to start

such a requirement would be determined based on factors such as cost effectiveness, the number of consumers affected, and the achievable emission reductions.

Table 4.3 shows the estimated 2005 and 2010 emission benefits of requiring annual testing of vehicles over 15 years old based on ARB's EMFAC2002 emissions model. The analysis assumes that the provision for annual testing of vehicles over 15 years old would roll forward each year, meaning that, if it started in 2004, it would affect model years 1976-1989 and, in 2010, it would affect model years 1982-1995 (assuming no changes to the 30-year rolling exemption). In 2005, this provision would affect about 4.4 million vehicles, and in 2010, it would affect about 5.4 million vehicles. The benefits shown in Table 4.3 would be greater if this program improvement were implemented in conjunction with replacing the 30-year rolling exemption with an exemption for pre-1976 model year vehicles only.

Table 4.3: Emission Benefits for Enhanced Areas from Requiring Annual Inspections for Vehicles Over 15 Years Old (assuming no change to 30-year rolling exemption)

Year	HC (tpd)	NOx (tpd)
2005 Emission Benefits (annual testing for 1977-1990 model year vehicles)	10	15
2010 Emission Benefits (annual testing for 1982-1995 model year vehicles)	9.4	18

It is appropriate to roll the annual testing provision forward each year at least for several years under the assumption that pre-1996 cars will continue to deteriorate at a rate similar to that seen today. However, it may not be appropriate to require annual testing once newer cars (those manufactured starting in the mid-1990s) reach the age at which annual testing would be required. These vehicles, subject to the Low Emission Vehicle program requirements and equipped with OBD II (starting in 1996), were initially cleaner than previous model years and have more sophisticated emissions controls in place. A decision to inspect these newer cars annually as they age could be decided once data on their in-use performance are available.

An annual testing program for older vehicles would be most efficient and effective if it is targeted at the cars most likely to fail their Smog Check. While the failure rates for cars older than 15 years are 30-40 percent – over twice the fleet average failure rate, a majority (60-70 percent) of these vehicles still pass their Smog Check tests. DCA/BAR would implement an annual testing program for older vehicles in conjunction with a "clean screen" program to except a fraction of the older vehicles that have the highest likelihood of passing the Smog Check inspection from the annual testing requirement. These vehicles would still be subject to the current biennial testing requirement. Such a provision would minimize the impact on consumers and improve the cost-effectiveness of this program improvement by focusing the annual testing requirement only on those vehicles that are expected to fail the test.

DCA/BAR is considering two "clean screen" approaches. A LEP could be developed based on historical Smog Check data, similar to the approach for excepting the cleanest five and six year

old vehicles. (See Section 4.2 for more details.) It may also be possible to use remote sensing to "clean screen" vehicles. ARB and DCA/BAR have started a pilot study to evaluate the appropriate uses of remote sensing in the Smog Check program. Once this pilot study is complete, ARB and DCA/BAR will be able to determine how remote sensing could be used to target the annual testing requirement most effectively.

To illustrate the potential cost effectiveness of an annual testing program for older vehicles, staff estimated the cost-effectiveness of requiring annual testing for vehicles over 15 years old to be less than $10,000 per ton if all vehicles were subject to the requirement. As noted above, the cost effectiveness would improve by "clean screening" the vehicles that are most likely to pass their Smog Check inspections.

Recommendation: Implement an annual inspection program for older vehicles. DCA/BAR would implement an annual testing program for older vehicles in conjunction with a "clean screen" program to except a fraction of the older vehicles that have the highest likelihood of passing the Smog Check inspection from the annual testing requirement. More frequent inspections would require a change in State law. If DCA/BAR were to implement an annual testing program for older vehicles, the exact vehicle age at which to start such a requirement would be determined based on factors such as cost effectiveness, the number of consumers affected, and the achievable emission reductions.

> **Recommendation #3** – Provide authority to require annual inspections of older vehicles, and implement an annual testing program in conjunction with a "clean screen" element to focus the requirement on the vehicles most likely to fail. This would require a change in State law.

Consumer/Industry Impacts: Owners of older vehicles subject to annual inspection under this change would incur additional testing costs and may incur additional repair costs (if their vehicles failed the inspection). To minimize consumer impact, this change would be implemented with a "clean screen" element to focus the annual testing requirement on vehicles most likely to fail. Because specific implementation details such as the model years subject to annual testing and the fraction of vehicles to "clean screen" have not yet been resolved, the exact cost to consumers has not yet been estimated.

To provide an upper bound of potential consumer cost, staff has estimated the additional cost if all vehicles 15 years and older were subject to annual testing, without a "clean screen" element. About 4.4 million vehicles (or 20 percent of the enhanced program fleet) will be 15 years or older in 2005. Under the current biennial testing requirements, 2.2 million of these vehicles are tested each year. With an annual testing requirement, an additional 2.2 million vehicles would be tested each year. Assuming an average Smog Check cost of $46, an average repair cost of $143, and an annual failure rate of about 23 percent for these older vehicles, consumers would potentially pay $101 million in testing and $72 million in repairs annually. Some motorists would qualify for financial assistance through the Consumer Assistance Program, thus lowering the estimated repair costs. Actual costs and the number of impacted consumers are expected to be substantially lower with an effective "clean screen" provision.

Motorists whose vehicles are repaired earlier than they would have been under the existing program would reap several benefits, including better running vehicles, improved fuel economy, improved vehicle operation and reliability, thereby increasing the likelihood of passing their next Smog Check inspection.

While this change would subject consumers to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the bounding assumptions cited above, the industry could potentially realize additional revenues of $173 million annually from the 2.2 million additional tests and the associated repairs for failing vehicles.

4.5 Annual Testing for High Mileage Vehicles

Background: Recognizing that vehicles driven high miles annually need more frequent inspections (and repairs) to minimize emission outputs, DCA/BAR was provided the authority in 1994 to require annual testing of high mileage fleet vehicles. However, the statutory provision is limited to only those vehicles owned by businesses that voluntarily elect to participate in DCA/BAR's business fleet program. Thus, implementation of the current provision would impact only a portion of the high mileage vehicles, and provides a disincentive to participate in the business fleet program.

Evaluation: As part of an ongoing effort to determine whether high mileage fleets (such as taxicabs) are being adequately maintained to prevent excessive emissions, ARB conducted a voluntary inspection program of taxicab fleets in the San Francisco and Los Angeles areas during 2002. The program was designed to identify the fraction of the taxicab fleet with excess emissions, the potential emission benefits from more timely repairs, and potential changes to the Smog Check program that could address these excess emissions.

Under the program, ARB conducted approximately 1,600 vehicle inspections on 1992-2002 model year taxicabs. Some of these inspections were scheduled in advance with the fleet operator and others were unannounced inspections of randomly selected vehicles. Inspections were designed to match the visual portion of the State's Smog Check test. Each vehicle received a visual inspection to determine the condition of emission control system components, including the air injection system, catalytic converter, evaporative emission system, exhaust gas recirculation system, oxygen sensor, positive crankcase ventilation system, and other components monitored by the onboard diagnostic (OBD) system and its associated malfunction indicator light. In addition, for vehicles equipped with OBD II (1996 and newer model year vehicles), the vehicle's engine operational parameters and diagnostic information were retrieved using an OBD II diagnostic scan tool. Approximately 75 percent of the vehicles inspected were equipped with OBD II.

Table 4.4 presents the results of these inspections. The overall failure rate was about 27 percent, with a "failure" meaning that one or more of the emission control system components was non-operational either due to deterioration or tampering.

Table 4.4: Number of Failing Inspections By Inspection Type

All Inspections	Scheduled Inspections	Random Inspections
432 out of 1602 (27%)	257 out of 1158 (22%)	175 out of 444 (39%)

To put these extremely high failure rates in perspective, ARB compared the failure rate observed in the taxicab fleet with the failure rate observed in the overall fleet through Smog Check testing using the most recent year of Smog Check data (collected between May 2002 and April 2003). While 27 percent of the taxicabs failed their inspections during this study, the overall failure rate for the entire fleet is about 16 percent. Furthermore, the overall fleet failure rate for 1992-2002 models (vehicles the same age as the taxicabs tested) is only around five percent.

One reason for the vast disparity in failure rates between taxicabs and the overall fleet is the high mileage driven by taxicabs. Based on data collected during this inspection program, ARB estimates the average taxicab miles traveled in 2002 to be 58,000 miles per year. This is at least four times the mileage that an average passenger car drives. With taxicabs accruing mileage at a much higher rate and Smog Checks occurring only once every 116,000 miles on average (versus once every 20,000-30,000 miles for a typical car), emission control components will deteriorate and fail at a higher rate. This suggests that biennial Smog Check testing is not sufficiently frequent to diagnose excess emissions in high mileage vehicles in a timely manner. Annual testing would limit the amount of time before excess emissions are identified and fixed. ARB's study focus began with taxicabs, but has expanded in 2003 to include other high mileage fleets such as shuttle-type vehicles, limousines, and other privately owned commercial transportation vehicles. Preliminary data collected for shuttle vans indicate failure rates similar to those seen for taxicabs.

As part of this inspection program, ARB tested the exhaust emissions of 43 OBD II equipped taxicabs to estimate the overall emissions of the taxicab fleet and the emission benefit from repairing failing vehicles. Test vehicles were divided into two groups: (1) 28 vehicles with no OBD indicated failures (i.e., malfunction indicator light off) that were tested to establish the baseline emission rate; and (2) 15 vehicles with OBD failures (i.e., malfunction indicator light on) that were tested before being repaired and then tested after repairs were made to fix the fault codes indicated by the OBD II system.

Based on the before and after repair test data, failure rate data for OBD II vehicles, and annual taxicab miles traveled data collected during the inspection program, ARB estimated the potential emission benefits from inspecting and repairing failing taxicabs more frequently. Assuming that the failure rate observed in San Francisco and Los Angeles taxicab fleets during this inspection program is the same for the statewide taxicab fleet of about 20,000 vehicles based on Department of Motor Vehicle (DMV) estimates, ARB estimated the potential statewide emission benefits from requiring more frequent inspection and repair of taxicabs as shown in Table 4.5.

Table 4.5: Potential Emission Reductions from More Frequent Inspections of Taxicabs

HC (tpd)	CO (tpd)	NOx (tpd)
0.2	3.6	0.6

While these overall emission reductions are not large, they are quite high on a per vehicle basis considering that the taxicab fleet comprises only 20,000 vehicles. Furthermore, taxicabs are only one example of the high mileage fleets operating in California. A review of the Smog Check test data for 2002 suggests that up to three percent of the fleet was driven high mileage, that is more than 25,000 miles per year. If the estimated reductions from 20,000 taxicabs are ratioed to the three percent of the enhanced program area fleet driven high mileage, the resulting emission reductions would be 6 tpd HC, 102 tpd CO, and 17 tpd NOx. This provides a rough estimate of potential benefits from more frequent testing of all high mileage vehicles. It should be noted that this is an upper bound of potential benefits; not all these vehicles drive as many miles as the 58,000 miles driven annually on average by taxicabs, so the actual benefits would be somewhat lower than those presented above.

Based on the emissions data from the taxicab study and average test and repair costs, the cost-effectiveness of requiring annual Smog Check inspections for taxicabs instead of biennial inspections is estimated to be $6,900 per ton.

Recommendation: Based on the analysis summarized above, the current biennial inspection requirements should be amended so that the State is given the authority to require more frequent inspections of all high mileage vehicles that are traveling more than twice the average miles per year.

> **Recommendation #4** – Provide authority to require more frequent inspections of all vehicles traveling more than twice the average miles per year of the California fleet. This would require a change in State law.

Consumer/Industry Impacts: Under this change, owners of vehicles that travel at miles more than twice the fleet average could potentially be subject to annual inspection in which case they would incur additional testing costs and may incur additional repair costs (if their vehicles failed the inspection). Because specific implementation details have not yet been worked out, the exact number of vehicle owners affected and the associated costs have not yet been estimated. For example, DCA/BAR may start implementation by focusing on fleet vehicles with potentially high annual mileage, instead of focusing on individually owned vehicles which may be more difficult to identify.

As in the previous section, staff has estimated the additional cost if all "high mileage" vehicles were subject to annual testing in order to provide an upper bound of potential costs to vehicle owners. About three percent of the fleet, or 560,000 vehicles in enhanced areas, accumulate greater than 25,000 miles per year. Under the current biennial testing requirements, only half these vehicles would be required to have a Smog Check each year. With an annual testing requirement, an additional 280,000 would be tested each year. Assuming an average Smog Check cost of $46, an average repair cost of $143, and a failure rate of about 27 percent for these high mileage vehicles (which is the average failure rate observed in ARB's taxicab study), vehicle owners could potentially pay $13 million in testing and $11 million in repairs annually. Some motorists would qualify for financial assistance through the Consumer Assistance Program thus lowering the estimated repair costs.

Vehicle owners whose vehicles are repaired earlier than they would have been under the existing program would reap several benefits, including better running vehicles, improved fuel economy, improved vehicle operation and reliability, thereby increasing the likelihood of passing their next Smog Check inspection. While this change would subject some vehicle owners to additional costs, it would generate a corresponding increase in business opportunities for the Smog Check station industry. Using the bounding assumptions cited above, the industry could potentially realize additional revenues of $24 million annually from the 280,000 additional tests and the associated repairs for failing vehicles.

4.6 Station Performance

The next four sub-sections present an evaluation of Smog Check station performance. The first sub-section (Section 4.6.1) compares the ability of Test-Only and Test-and-Repair stations to properly identify polluting vehicles. The second sub-section (Section 4.6.2) contains an evaluation of the quality and durability of Smog Check repairs. Based on the findings from these analyses, staff evaluated potential program changes that would improve station performance. The third sub-section (Section 4.6.3) presents an evaluation of one approach for improving the quality of repairs – setting more stringent post-repair cutpoints in order to ensure more complete repairs of vehicles' emission control systems. The fourth sub-section (Section 4.6.4) includes an evaluation of the Smog Check enforcement program and presents recommendations for improving the quality of repairs and overall station performance. The final sub-section (Section 4.6.5) contains a summary of the major findings of this station performance analysis.

4.6.1 Comparison of Test-Only and Test-and-Repair Stations

Background: There are about 8,000 Smog Check stations operating statewide, of which 6,600 are in the state's enhanced areas (including the recent addition of the Bay Area to the enhanced program). Stations and technicians are responsible for properly inspecting and repairing vehicles that have tampered or defective emission control systems. Failure to perform proper inspections and repairs results in a loss of potential emission reductions from the Smog Check program. To ensure that inspections are performed properly, DCA/BAR pursues disciplinary actions against stations and technicians for violations of the Smog Check program laws and regulations.

One element of California's enhanced Smog Check program is the use of Test-Only stations for inspecting a portion of the enhanced area fleet. Test-Only stations are licensed by DCA/BAR to perform tests on vehicles, but are prohibited from performing any repair services. Test-and-Repair stations are licensed by DCA/BAR to perform both tests and repair services. The most likely to fail vehicles are directed by DCA/BAR to Test-Only stations where they are believed to obtain a more unbiased inspection. This provision is fundamental to the design of the current enhanced Smog Check program and was the feature that allowed California to receive U.S. EPA approval of its program and avoid Test-Only inspections for all vehicles.

Evaluation: Two approaches were used to compare the performance of Test-Only and Test-and-Repair stations. The first approach relies on a statistical ranking methodology to categorize

stations into "high performing" or "low performing" stations. This method[3] compares observed and expected inspection failure rates for each station, then ranks each station based on the result. Stations reporting failure rates that meet the expected failure rate are doing the best job identifying polluting vehicles. Stations that are failing fewer vehicles than would be expected have a greater likelihood of inappropriately passing vehicles that should fail Smog Check.

This approach was used to evaluate station performance based on Smog Check data collected in both 1999 and 2001. Table 4.6 shows the percent of stations and percent of vehicles inspected in each ranking category. Both the 1999 and 2001 data show similar station performance patterns even though more vehicles were directed to Test-Only stations in the 2001 data set. In both cases, the majority of Test-Only stations (about 60 percent) were among the best performing stations, whereas only about 20 percent of the Test-and-Repair Stations were placed in the best performing category based on this measure. Test-and-Repair stations are more uniformly distributed among the "best" to "worst" categories.

Table 4.6: Percent of Stations by Rank Using Smog Check Inspection Records (based on data collected in 1999 and 2001)

1999 Evaluation				
Ranking (Percent)	**Enhanced Test-Only**		**Enhanced Test-and-Repair**	
	Percent of Stations	**Percent of Vehicles Inspected**	**Percent of Stations**	**Percent of Vehicles Inspected**
0 - 25 (Best)	59.9	12.8	21.2	19.3
25 - 50	21.5	3.6	25.4	17.3
50 - 75	12.3	2.5	26.4	18.1
75 – 100 (Worst)	6.3	1.4	27.0	25.0
All	100.0	20.2	100.0	79.8
2001 Evaluation				
Ranking (Percent)	**Enhanced Test-Only**		**Enhanced Test-and-Repair**	
	Percent of Stations	**Percent of Vehicles Inspected**	**Percent of Stations**	**Percent of Vehicles Inspected**
0 - 25 (Best)	58.1	19.2	19.8	16.2
25 – 50	18.9	4.5	26.1	12.9
50 – 75	12.4	3.0	27.1	14.9
75 – 100 (Worst)	10.6	3.6	26.9	25.7
All	100.0	30.4	100.0	69.6

A second measure used to evaluate station performance is a repeat emissions analysis. This analysis uses a statistical technique designed to identify stations with unusual clusters of distinctive emissions patterns. The occurrence of such similar emissions readings on initial test inspection data can be an indication of improper, or fraudulent, activity such as "clean piping" (testing the same clean vehicle in place of another vehicle(s) that may otherwise fail). Each station is assigned a repeat emission index score; with higher numbers representing better

[3] The June 27, 2000 report "Smog Check Station Performance Analysis" by Eastern Research Group (ERG) and de la Torre Klausmeier Consulting (dKC) contains the original ranking analysis based on 1999 data. The report found that much greater exhaust emission reductions were observed for vehicles certified at Test-Only stations than Test-and-Repair stations.

performance. Index scores near 100 indicate few incidences of repetitive emissions. On the other hand, scores near zero indicate a relatively large number of repetitive emissions.

Table 4.7 presents the repeat emissions analysis results, sorted by station type. Over 95 percent of Test-Only stations achieve a perfect score of 100 on the repeat emissions evaluation. In contrast, only 66 percent of Test-and-Repair stations achieve a perfect score. More importantly, 21 percent of Test-and-Repair stations are ranked very low on this index compared to only about one percent of Test-Only stations based on station data collected in 2001.

Table 4.7: Repeat Emissions Analysis Results

Repeat Emissions Index Score	Enhanced Test-Only	Enhanced Test-and-Repair
	Percent of Stations	Percent of Stations
100 (Best)	95.7	66.4
Greater or equal to 15 and less than 100	3.0	12.3
Less than 15 (Worst)	1.3	21.3
All	100.0	100.0

Based upon these results, nearly all Test-Only stations are performing according to expectations; however, one-fifth of the Test-and-Repair stations are not.

Conclusions: The two different analytical approaches both reveal that more Test-Only stations rank among the best performing stations when compared to Test-and-Repair stations in terms of identifying polluting vehicles.

- These results indicate that California's Test-Only approach is working. Because the Test-Only stations are doing a better job of identifying failing vehicles (which leads to these vehicles being repaired), additional emission reductions are being achieved by directing vehicles to Test-Only stations.

- These results also support recent program changes that increased the fraction of vehicles directed to Test-Only for biennial inspections in the enhanced area fleet.

- These analyses show that a significant portion of stations is not performing as well as they should in identifying polluting vehicles.

In Section 4.6.4, changes to the Smog Check enforcement program that would improve the performance of stations that are not meeting expectations are recommended.

4.6.2 Evaluation of Repair Effectiveness

Background: The previous sub-section shows that some stations are not performing as well as others in identifying polluting vehicles. This section complements that analysis by evaluating another important element of station performance, the quality and durability of repairs. These factors directly impact the emission reductions achieved by the Smog Check program. If vehicle

repairs last for only a short time, the emission benefits associated with the repairs are lost quickly.

Evaluation: Both roadside data and Smog Check program data were used to evaluate the accuracy of station data as well as repair effectiveness. Roadside test data is considered a more accurate measure of program effectiveness than station data. Pre-inspection repairs, differences in station performance as well as fraudulent station/technician behavior can affect station data statistics. The following three comparisons for vehicles undergoing their biennial inspection as well as tested through the DCA/BAR roadside inspection program are provided.

The first comparison examines average emission rates for roadside vehicles following their Smog Check inspection result. Table 4.8 shows average roadside emission rates (ASM concentrations converted to FTP grams per mile) for vehicles after they had received an enhanced Smog Check. All average emissions results have been weighted by the appropriate model year travel fractions. Vehicles are grouped into those that failed their initial inspection, then passed after repairs and those that passed their initial inspection. On average, vehicles that pass their initial test have significantly lower emission rates than vehicles that were repaired to pass. If failing vehicles could be repaired such that their emission levels are closer to those of passing vehicles, additional emission reductions could be achieved. In Section 4.6.3, staff evaluated a potential program change that would help accomplish this.

Table 4.8: Average FTP-Based Emission Rates For Roadside Vehicles Following Their Smog Check Inspection*

Smog Check Result	HC (g/mi)	CO (g/mi)	NOx (g/mi)
Vehicles Failing Initial Inspection and Subsequently Repaired	1.09	13.53	1.16
Vehicles Passing Initial Inspection	0.76	9.93	0.88
Difference	0.33	3.60	0.28

* Based on roadside vehicles tested between January 2000 and October 2002.

The second comparison looks at the subsequent roadside tailpipe failure rate relative to the after repair Smog Check tailpipe failure rate. Table 4.9 shows the subsequent roadside tailpipe failure rate for vehicles that initially failed, then passed their Smog Check. Vehicles selected had a roadside test within one year of the Smog Check inspection. If all of the repairs were successful and durable, the roadside failure rate would be near zero. However, based on roadside data collected in 2001, 40.4 percent of the repaired vehicles tested failed the subsequent roadside test. This suggests that many of the failing vehicles did not get repaired properly or the repairs did not last. The average after Smog Check roadside test was performed approximately five to six months after the passing Smog Check result, so some new defects may have occurred.

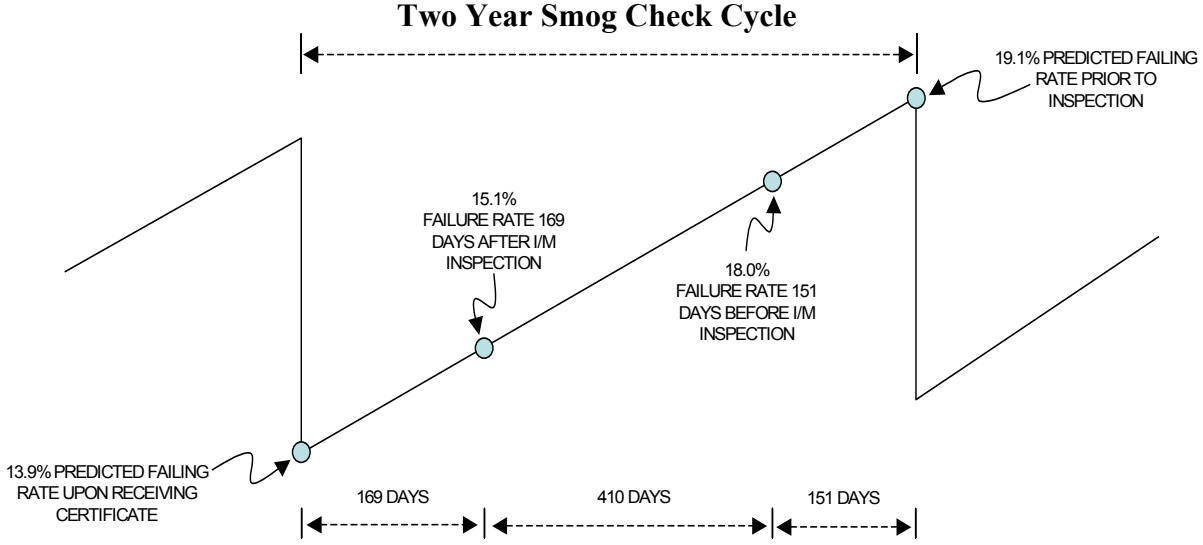
Table 4.9: Roadside Failure Rate For Vehicles After Smog Check Repairs

Roadside Testing of Vehicles After Failed Enhanced Smog Check and Subsequent Repair	Number of Vehicles	Roadside Failure Rate*
	735	40.4%

* Weighted by the Vehicle Inspection Data (VID) model year distribution from December 2000 through November 2001.

The third comparison examines roadside tailpipe failure rates before and after Smog Check. Figure 4.4 shows the relationship between failure rate and time since/before Smog Check based on the roadside test results. This analysis considered vehicles where the roadside test occurred within one year of the Smog Check inspection. The average number of days "after" Smog Check for this data set is 169. The average number of days "before" Smog Check is 151. To estimate the before and after Smog Check failure rate at the time of the Smog Check, a linear extrapolation of the roadside data was performed. The linear extrapolation indicates that the failure rate immediately after Smog Check would be 13.9 percent and the failure rate for vehicles about to get a Smog Check would be 19.1 percent. If the relationship between failure rate and time since Smog Check is truly linear, this could indicate questionable test results. However, it is possible that more of the vehicles actually pass Smog Check after receiving ineffective or partial repairs and then deteriorate rapidly. Regardless of whether the deterioration is linear or non-linear, this analysis shows a significant portion of the vehicles that fail Smog Check are not effectively repaired.

Figure 4.4
Variation in Failure Rates For Vehicles Tested at the Roadside Before and After Biennial Smog Check


Two Year Smog Check Cycle
19.1% PREDICTED FAILING RATE PRIOR TO INSPECTION
15.1% FAILURE RATE 169 DAYS AFTER I/M INSPECTION
18.0% FAILURE RATE 151 DAYS BEFORE I/M INSPECTION
13.9% PREDICTED FAILING RATE UPON RECEIVING CERTIFICATE
169 DAYS
410 DAYS
151 DAYS

Conclusions: The primary goal of the Smog Check program is identification and repair of polluting vehicles. The three comparisons above indicate vehicles are not being optimally repaired and maximum emission benefits are not being achieved.

- Analysis of Smog Check program data indicates final emissions for failing vehicles could potentially be lowered to the point that their emission levels are closer to those of passing vehicles.

- Analysis of Smog Check program data and roadside data show that repairs are not being adequately performed.

- Furthermore, Smog Check program data and roadside data show that vehicles passing Smog Check may have received ineffective or partial repairs and then deteriorated rapidly.

Several solutions have been identified to address the problems of poor performing stations and less than optimal repairs discussed above. These solutions include more stringent post-repair cutpoints (discussed in sub-section 4.6.3) and better/streamlined enforcement (discussed in sub-section 4.6.4).

4.6.3 More Stringent Cutpoints for After-Repair Tests

Background: Analysis of Smog Check program data indicates that a significant portion of vehicles requiring repairs to pass Smog Check are likely to fail the next time they are tested (see Section 4.6.2). Since the overall program failure rate is less than 20 percent, this indicates that the repairs being performed are not suitably thorough. Many vehicles are only receiving partial, incremental repairs until they pass the test. When all emissions-related defects are not corrected, post-Smog Check deterioration in emissions control can rapidly occur. This is especially problematic in cases where the cause of excessive emissions, such as an intermittent misfire problem, is not eliminated. Installing a new catalytic converter on such vehicles may be sufficient to get them to pass the Smog Check test, but the continuing misfire causes rapid deterioration of the new catalytic converter and an increase in emissions. Additional emission reductions could be achieved if vehicle repairs are more complete and longer lasting.

Evaluation: Staff compared the average roadside emissions test results for vehicles that passed their initial Smog Check test to those that failed their initial test but subsequently received a Smog certificate (i.e., they were either repaired and passed, or issued a repair cost waiver[4]) as shown in Table 4.10. The roadside ASM emission test results have been converted to grams per mile values of the FTP to reflect on-road driving. All average emissions results have been weighted by the appropriate model year travel fractions. Comparison of the two sets of emissions results show that vehicles passing their initial Smog Check test have significantly lower emissions for all three pollutants than vehicles that fail initially but subsequently receive a certificate after being repaired. This difference in emission rates suggests the potential for failing vehicles to be repaired to lower emission levels than are currently being achieved.

[4] Few repair cost waivers are being issued at present, most likely due to the availability of the Consumer Assistance Program. The current waiver rate is between 0.1-0.2 percent of the total inspections performed.

Table 4.10: Comparison of Emissions Between Vehicles Passing Initial Inspection and Vehicles Failing Initial Inspection and Subsequently Receiving a Smog Certificate

Smog Check Result	HC (g/mi)	CO (g/mi)	NOx (g/mi)
Vehicles Failing Initial Inspection and Subsequently Repaired	1.09	13.53	1.16
Vehicles Passing Initial Inspection	0.76	9.93	0.88
Difference	0.33	3.60	0.28

Based on roadside vehicles tested between January 2000 and October 2002.

There are several approaches to addressing incomplete repairs. One would be to increase the stringency of the inspection standards (cutpoints), which would force more thorough repair. However, this approach would also fail more vehicles on initial inspection. Some of these vehicles would have only marginally high emissions, resulting in less cost-effective repairs.

A second approach would be to establish an inspection standard for repair that is more stringent than the inspection standard used to determine if a vehicle initially passes or fails. This approach would not affect the number of vehicles initially failing the test. However, it would assure that those vehicles that fail are more fully repaired and likely to remain lower emitters for a longer time.

In order to estimate the emission reductions associated with more stringent post-repair cutpoints, the level of the cutpoints would need to be known. At this time, DCA/BAR has not completed an assessment of the levels at which post-repair cutpoints should be set. This assessment will include a thorough evaluation of the emissions levels that can be achieved in practice with reasonably priced repairs and the need to ensure that cutpoints are not set at levels that cannot be achieved.

It is important to note that excess emissions targeted under this potential change to the Smog Check program are also targeted under a control measure in the 2003 SIP revisions for the South Coast and San Joaquin Valley. In SIP measure LT/MED-DUTY-1, ARB is evaluating the feasibility of a statewide program that would require the replacement of emission control components on older passenger cars. If such a program were implemented, some of the reductions would overlap with those from this Smog Check change. Staff will take this into account in estimating the emission benefits from each program.

Conclusion: Given the potential benefits associated with applying more stringent standards for the after-repair test, DCA/BAR is planning to evaluate a program change that would require separate standards for the after-repair test, under its current statutory authority. In addition to providing additional emission reductions, this change would protect consumers by helping to ensure that emission defects are fully repaired. This should reduce the number of repaired vehicles that fail their next Smog Check as a result of incomplete repairs. Once DCA/BAR finishes its evaluation of the level at which post-repair cutpoints could be set, it will provide an estimate of the associated emission reductions and a cost effectiveness estimate as part of any regulatory proposal to implement this program change.

DCA/BAR is planning to evaluate a change to the Smog Check program that would set more stringent post-repair cutpoints in order to ensure more complete and durable repairs of vehicles that fail Smog Check.

Consumer/Industry Impacts: This change would not require any additional or more frequent inspections nor would it result in any additional failing vehicles. However, it would subject a fraction of the 1.1 million consumers whose vehicles fail their enhanced Smog Check inspection each year to additional repair costs. The exact number of consumers affected and the associated costs can only be estimated once the specific post-repair cutpoint levels are determined. Currently, some failing vehicles are repaired to levels well below existing cutpoints. If post-repair emission levels of these vehicles are below the new cutpoints, these consumer would not be impacted by this program change. However, other vehicles, such as those repaired to levels just below the current cutpoints, would likely require additional repairs to pass the more stringent cutpoints. These consumers would potentially incur additional costs. However, these motorists would also benefit from fully repaired emission defects, resulting in better performance as well as more durable repairs.

With respect to the Smog Check station industry, there would be no impact on the number and cost of inspections. However, additional repair revenue would likely be generated for the Smog Check repair industry because this change may result in more comprehensive repairs for a fraction of the failing vehicles. The consumer and industry impacts will be thoroughly and quantitatively evaluated as DCA/BAR develops a detailed proposal for this program change.

4.6.4 Improving Station Enforcement Actions

Background: DCA/BAR tracks "poor performing" stations through traditional enforcement operations. Stations are targeted based on criteria including: quality assurance inspections; consumer complaints; anonymous complaints; and/or anomalous activity in the station's Smog Check inspection records. These investigations can range from overt fact finding to covert methods, including surveillance and the use of documented undercover vehicles. Resulting actions range from official conferences to fines to license revocation and finally to criminal penalties for technicians or station owners convicted of fraud. The successful prosecution of cases involves the coordination of three State agencies: DCA/BAR; the Attorney General's (AG's) Office; and the Office of Administrative Hearings (OAH). This section includes an evaluation of the Smog Check enforcement program and presents recommendations for improving enforcement. Better enforcement provides a mechanism to improve the performance of stations in both identifying polluting vehicles and repairing them.

Evaluation: DCA/BAR relies on the Licensing Section of the Civil Division of the AG's office for both the preparation of formal accusations and the legal representation in the adjudication of administrative actions. The Licensing Section of the AG's office consists of approximately 100 Deputy Attorneys General statewide that represent some 34 State agencies in taking administrative action against holders of professional and vocational licenses. During FY 2001/2002, the AG's Licensing Section caseload consisted of more than 3,000 filings for administrative action. The initiation of the administrative disciplinary process begins with the

preparation and serving of an accusation, which is a formal document containing the charges against a licensee. DCA/BAR is among 33 other State agencies that contribute to the AG's annual workload and it is not uncommon for the preparation and serving of an accusation to take as much as eight to 12 months once a case has been forwarded for representation.

The time frame for the processing of cases at the AG's office has also been impacted by civil litigation in which the AG's office has represented the DCA/BAR. Some of the reasons for this litigation include: appeals of DCA/BAR administrative decisions, lawsuits filed against DCA/BAR attempting to prevent it from either properly investigating cases against licensees or challenging its authority to discipline licensees, and litigation against exhaust gas analyzer manufacturers for failing to meet DCA/BAR specifications. During FY 2000/2001, the amount of AG time devoted to civil litigation on behalf of the DCA/BAR totaled 8,543 hours and 10,497.5 hours in FY 2001/2002. Similar estimates for FY 2002/2003, when available, are expected to increase dramatically due to several very high profile cases.

Diverting Deputy Attorneys General to civil litigation on behalf of the DCA/BAR diminishes the number of Deputies and/or time that they can otherwise devote to the administrative prosecution of DCA/BAR cases. Despite the diversion of AG resources to these other areas of legal representation, the cost of engaging the AG's office for representation, as compared with the average cost of engaging outside counsel to represent the DCA/BAR, remains a bargain[5], particularly when factors such as the specialized knowledge needed to handle these often highly complex and technical cases effectively is considered.

The OAH, a quasi-judicial tribunal that hears administrative disputes, is the other State agency that completes the cycle of investigation (DCA/BAR), prosecution (AG) and adjudication (OAH). OAH currently retains 53 independent Administrative Law Judges (ALJs) to conduct hearings for over 100 State and 500 local government agencies. Therefore, DCA/BAR is only one of over 600 State and local government agencies utilizing the services of the OAH. Consequently, because of the large demand for the utilization of OAH's services by various government agencies, the adjudication process is continually backlogged. The impact this has on DCA/BAR cases is that it allows non-complying Smog Check stations and technicians to remain in business until such time as their right to due process is fulfilled. The delay in obtaining hearing dates from OAH is particularly acute in Southern California.

Table 4.11 shows the average number of days necessary to adjudicate Smog Check enforcement cases. The two major stages of this adjudication process are depicted. Listed first is the average number of days elapsed from the date a case is first referred to the Attorney General's office until the date an accusation is filed. There is currently a 7.5 month backlog of Smog Check cases at the AG's office, awaiting the drafting of an accusation. Listed second on Table 4.11 is the average number of days elapsed from the date an accusation is filed until a decision is rendered. This tracks the number of days it takes for OAH to conduct a hearing and render a decision in the matter. There is currently a 13.5 month backlog of cases at OAH. Collectively, this means that in FY 2002/2003, it took 21 months (almost two years) to fully adjudicate a Smog Check case following the completion of an investigation.

[5] The average hourly cost for AG service billings for attorney representation is less than half the average cost of outside counsel. ($105 compared to $265.)

Table 4.11: Days to Adjudicate Smog Check Enforcement Cases

Result	Fiscal Year			
	1999/2000	2000/2001	2001/2002	2002/2003
Average Days to Accusation*	192	193	278	225
Average Days to Decision**	284	298	443	407

* From completed investigation to formal charges being filed.
** From formal charges filed to conclusion of disciplinary case.

During this evaluation period, the impact of the 2001 hiring freeze and the 2000/2001 and 2001/2002 budget bills has had a dramatic effect on DCA/BAR and its enforcement program. Not only was DCA/BAR unable to fill its vacancies, it permanently lost 28.1 positions, including 8.5 positions directly responsible for enforcement in FY 2000/2001. In FY 2001/2002, DCA/BAR lost another 20.8 positions, including 2.3 directly tied to enforcement. Finally, DCA/BAR lost 42.5 additional positions in FY 2002/2003, including 17 enforcement positions. In summary, since 2001, DCA/BAR has lost a total of 91.4 positions, including 27.8 enforcement positions. Despite the decrease in resources, long cycle times and backlogs, DCA/BAR and the AG's office have managed to increase the amount of enforcement as shown in Table 4.12.

Table 4.12: DCA/BAR Enforcement Program Statistics

Result	Fiscal Year						
	1996/ 1997	1997/ 1998	1998/ 1999	1999/ 2000	2000/ 2001	2001/ 2002	2002/ 2003
Smog Check Licensees with Accusations Filed	175	325	207	343	301	379	407
Smog Check Licensees with Citations Issued	513	510	647	333	675	1,220	1,302
Referrals to DA/CA for Criminal Action	77	72	57	62	64	54	74

Recommendation: Several approaches to cope with the statewide hiring freeze, the loss of a significant number of enforcement and prosecutorial positions, and the increased complexity of cases have been identified:

- Authorize additional funding to restore DCA/BAR enforcement positions as soon as the economy improves;

- Create a specialized prosecution unit within the Licensing Section of the AG's office to focus on Smog Check program cases. This would likely require direction from the Legislature; and

- Give DCA/BAR the statutory authority to retain a panel of highly experienced Administrative Law Judges dedicated solely to conducting hearings associated with disciplinary actions taken by DCA/BAR. This would require a change in State law.

> **Recommendation #5** – In order to improve the enforcement of Smog Check requirements and improve station performance, DCA/BAR should be authorized funding to restore enforcement positions; a specialized prosecution unit should be established within the AG's office to focus on Smog Check program cases which would likely require direction from the Legislature; and DCA/BAR should be given the statutory authority to retain Administrative Law Judges dedicated solely to conducting hearings associated with disciplinary actions taken by DCA/BAR which would require a change in State law.

Consumer/Industry Impacts: These changes are intended to improve DCA/BAR's enforcement of Smog Check program requirements. There should be no direct impacts on consumers and businesses that are lawfully abiding by the Smog Check requirements.

4.6.5 Major Findings of Station Performance Analysis

Staff evaluated several components of station performance: the performance of Test-Only stations compared to Test-and-Repair stations; the effectiveness of repairs regardless of station type; and the enforcement program as the mechanism to identify "poor" performing stations and take legal action. The three main findings are as follows:

- Test-Only stations rank among the best performing stations when compared to Test-and-Repair stations in terms of identifying polluting vehicles. Furthermore, greater emission reductions are achieved when a vehicle is directed to a Test-Only station rather than a Test-and-Repair station. These results support recent program changes that increased the fraction of vehicles directed to Test-Only for biennial inspections. The continued direction of the highest polluting vehicles to Test-Only stations is an effective method to obtain more emission reductions than would be realized at Test-and-Repair stations.
- Repairs are not being adequately performed regardless of the station type completing the final Smog Check inspection. Furthermore, marginal repairs lead to rapid deterioration followed by increased emission levels. DCA/BAR is planning to develop separate standards for the after-repair test. These standards would provide additional emission reductions and protect consumers by helping to ensure that emission defects are fully repaired.
- Additional resources are needed to streamline the current enforcement program. The program was severely impacted by the statewide hiring freeze since 2001, the loss of a significant number of enforcement and prosecutorial positions and the increased level in the complexity of cases. Better enforcement provides a mechanism to improve the performance of stations in both identifying polluting vehicles and repairing them.

4.7 Inspection of Smoking Vehicles

Background: Smoking vehicles can have an effect on air quality because they emit significantly more particulate matter than properly tuned vehicles. Vehicles may smoke all the time or only during start-up or only during acceleration. Under the California Motor Vehicle Code (Sections 27153 and 27153.5), it is against the law to operate a vehicle that emits excessive smoke. The CHP can cite vehicles for excessive smoke and, if warranted, impose a fine. These fines range from $100 to $250, depending on the type of vehicle, for first time offenders.

In addition, ARB and a number of air districts have implemented smoking vehicle programs to reduce visible exhaust from vehicles. Under these programs, drivers who spot a vehicle emitting excessive amounts of exhaust smoke can call a toll free complaint hotline to report it. After receiving a complaint, ARB or district staff mails an advisory letter to the owner informing them that a complaint has been filed against their vehicle. The letter advises smoking vehicle owners that their vehicle was reported to be smoking and recommends they have it repaired. The letter also alerts the owners to the fact that operating excessively smoking vehicles is a violation of the State Motor Vehicle Code and that they are subject to fines if cited by the CHP. After owners make the necessary repairs, they are asked to complete the smoking vehicle compliance form attached to the advisory letter. On average, more than 40 percent of the vehicle owners who receive an advisory letter return their completed compliance forms, stating that they have attended to their vehicles, either having it checked and, if warranted, having any needed repairs made.

An inspection for excessive smoke is not part of the current Smog Check program. While some smoking, gasoline-fueled engines also have high gaseous emissions of HC, NOx, and/or CO, this is not always the case, and a smoking vehicle can pass the current Smog Check inspection. Thus, an opportunity to complement other smoke reduction programs and further reduce the number of smoking vehicles is being missed.

Evaluation: Smoking vehicles are more than just a nuisance; they are a public health problem. Based on laboratory tests, smoking vehicles have particulate emission rates averaging 0.27 g/mi during normal operation. In contrast, vehicles in a proper state of repair have particulate emission rates at least 90 percent lower. Excess particulate emissions from smoking vehicles may be as much as 1.6 tpd based on an estimate that there are 200,000 smoking gasoline fueled light-duty vehicles currently driving 30 miles per day. These emissions can cause premature death.

Adding a smoke inspection component to the Smog Check program would provide an additional mechanism to ensure more effective enforcement of the State law prohibiting operation of smoking vehicles, complementing current enforcement mechanisms such as CHP citations and ARB/district complaint lines. The repair of smoking vehicles would reduce visible smoke and particulate emissions.

Recommendation: Incorporate an inspection for smoking vehicles during the Smog Check test. This would help reduce the number of smoking vehicles and would reduce particulate emissions and their associated health effects.

Recommendation #6 – Provide authority to include a smoke test of vehicles as part of the Smog Check inspection. This would require a change in State law.

Consumer/Industry Impacts: Adding a smoke inspection to the Smog Check program may add a minute or two to the current Smog Check inspection. Other than that additional time, most consumers would be unaffected by this change because it is estimated that only a small fraction of the fleet (about 200,000 vehicles) emit excessive smoke. Consumers whose vehicles are identified as smoking would incur additional repair costs. However, this would not be a new burden on consumers since State law already prohibits the operation of excessively smoking vehicles. This change would simply provide an additional mechanism to enforce the existing statute. Because excessive smoke is an indicator of an engine problem, consumers whose vehicles are repaired would reap the benefit of a better performing vehicle.

The Smog Check industry could incur some initial costs in training technicians to perform smoke inspections. Some test equipment may need to be purchased by stations, causing the inspection fee to be minimally increased as stations pass the cost along to consumers. Additional repair revenue would potentially be generated for the Smog Check repair industry from repairing smoking vehicles.

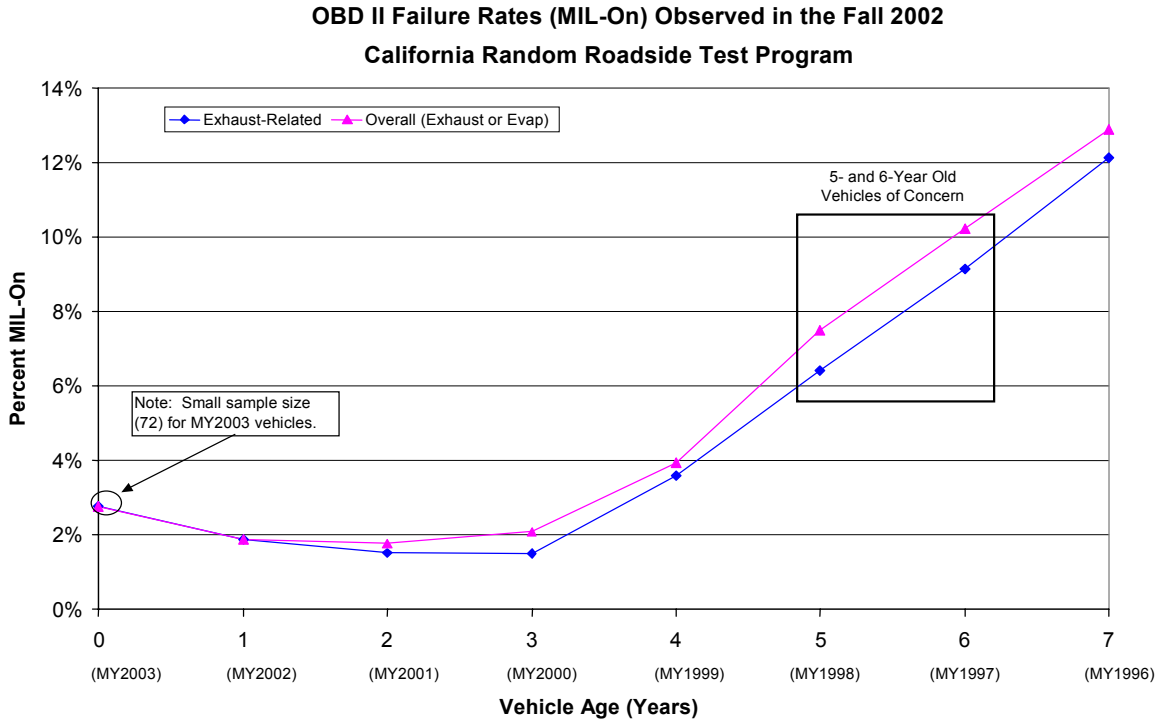
4.8 Model Year Exceptions from the Change of Ownership Inspection

Background: Since the early 1970s, vehicles have been required to obtain Smog Check inspections upon change of ownership. The exception for newer model year vehicles subject to the biennial Smog Check program does not apply to the change of ownership inspection requirement. The Smog Check requirement for vehicles that change ownership is a consumer protection mechanism as well as an emission reduction measure. It ensures that consumers are purchasing used vehicles with intact emission control components. However, improvements in vehicle emission control and engine management technology over the years have reduced the incidence of tampering, especially on newer model year vehicles. As a result, staff examined the impact of excepting newer model year vehicles that are two years old or less from the Smog Check inspection requirement upon change of ownership. Vehicles that are two years old or less are sufficiently under the emission control warranty time period, thereby offering a consumer protection component.

Evaluation: Smog Check station data from Spring 2003 shows a minimal overall failure rate (2.6 percent) and a negligible tamper rate (less than 0.05 percent) for vehicles that are two years old or less. The negligible tamper rate of less than five vehicles out of every 10,000 suggests that there is no longer a need to inspect these newer vehicles to protect consumers from purchasing vehicles that have been tampered with. Of the vehicles that do fail, the majority are OBD II-related failures and the owners are expected to respond to the malfunction indicator light (MIL) by seeking repairs at the dealership, which would be covered under the vehicle's warranty. Thus, the emission impact of excepting these vehicles from change of ownership testing is expected to be negligible.

In a separate analysis, OBD II failure rates for 1996 and newer vehicles were estimated from data collected during a special DCA/BAR roadside study in Fall 2002. These failure rates were used to estimate initial test failure rates in the analysis performed to evaluate the impact of excepting five and six year old vehicles (described in Section 3.3). Figure 4.5 shows the OBD II failure rates (i.e., MIL is on) for the five and six year old vehicles as well as vehicles that are four years old and newer. The figure illustrates that MIL-on rates increase substantially after three years of age (1999 and older vehicles). This effect most likely is related to the expiration of the typical three-year "bumper to bumper" warranty. (Please note that the upturn in failures for 2003 model year vehicles in Figure 4.5 is most likely an artifact of the extremely small sample size – two failures in 72 vehicles tested – rather than an indication that these vehicles are actually failing at a higher rate than 2000-2002 model year vehicles.)

Figure 4.5



Based on data from the DCA/BAR Executive Summary report, approximately 330,000 vehicles two years old or less statewide received a change of ownership inspection in calendar year 2002.

Recommendation: Except from the change of ownership Smog Check requirement vehicles purchased from new or used car dealers that are two years old or less and are still under full warranty. Since these vehicles are still under warranty, this change would continue to offer consumer protection as well as the consumer convenience realized by the exception. This would require a change in State law.

Recommendation #7 – Vehicles two years old or less that are still under full warranty should be excepted from the change of ownership Smog Check requirement. This would require a change in State law.

Consumer/Industry Impacts: This change would affect the estimated 330,000 consumers per year who sell their two year old or newer cars that are still under warranty. These consumers would save both time and the $46 cost (on average) of a Smog Check inspection, resulting in an overall savings of $15 million for California consumers. Smog Check stations would forego an estimated $15 million in testing revenue.

4.9 Evaluation of Other Potential Changes to the Smog Check Program

Staff examined several other potential program elements that could provide additional emission reductions and/or make the program more convenient for motorists. These include adding motorcycles and diesel-fueled vehicles (passenger, light-duty trucks and medium-duty trucks) to the program, improving compliance with vehicle registration requirements, and restarting the vehicle retirement program. Initial evaluation suggests that these improvements may have merit. However, additional studies are needed before recommendations for program changes could be made.

Inclusion of Motorcycles: The number of motorcycles registered in the State is approximately 400,000. These gasoline-powered vehicles emit the same pollutants as vehicles tested in the current Smog Check program, at higher rates. Evaporative emissions are a major problem as the sun shines directly on the fuel tank, heating the tank, readily releasing hydrocarbons into the environment during refueling. Due to their low annual mileage accumulation, motorcycles do not exhibit significant deterioration of emission control systems. However, motorcycles are subject to high rates of exhaust system tampering. Based on surveys by the Motorcycle Industry Council, 34 percent of on-road motorcycles have been retrofitted with aftermarket exhausts that eliminate the catalytic converter on catalyst-equipped motorcycles. The high rate of tampering will become increasingly significant from an emissions control perspective, as more motorcycles are factory-equipped with catalytic converters to meet more stringent, new vehicle emissions standards that have been adopted for model years 2004 and 2008. It is therefore becoming more important to consider including motorcycles in the program.

Before recommending adding motorcycles to the Smog Check program, additional study is needed regarding how this change would be implemented. For example, if the main concern is tampering with the emission control system, it might be appropriate to require only a visual inspection to verify that emission control components are intact instead of a full emissions test. After further investigation of appropriate tests for motorcycles in a Smog Check program, staff would evaluate potential emission reduction benefits, ease of implementation, impacts on motorists, and cost-effectiveness.

Inclusion of Diesel Vehicles: In California, there are over 200,000 diesel-fueled vehicles that are passenger cars, light duty-trucks or medium duty-trucks. Although diesel vehicles tend to have low HC emissions, these vehicles emit higher levels of NOx and

particulate matter than similar sized gasoline vehicles. Diesel-fueled vehicles are not currently part of the Smog Check program. As a result, the public may perceive that there is an inequity in the treatment of gasoline and diesel vehicles. In 1991, ARB conducted a preliminary evaluation of the potential for an I/M program for diesel cars. At that time, it was found repairing vehicles to reduce NOx emissions led to an increase in HC emissions, so there was no significant net NOx plus HC reductions, and it was found that repairs were not cost effective. However, it may be appropriate to reevaluate whether diesel vehicles should be added to California's enhanced Smog Check program. In order to consider whether a cost effective Smog Check program for diesel vehicles is feasible, staff would need to evaluate whether a test could be designed to identify excess emissions including particulate matter, whether repairs could be made to reduce those excess emissions, and whether a significant fraction of the fleet has excess emissions.

Improving Vehicle Registration Compliance: In ARB's August 17, 2000 letter to U.S. EPA on improving the Smog Check program, addressing administrative loopholes associated with the vehicle registration process was identified as a potential program improvement since the Smog Check inspection requirement is directly tied to vehicle registration. DCA/BAR recently began evaluating the vehicle registration process to determine if vehicles that should be subject to biennial Smog Check inspection are correctly identified and notified of the requirement, and that any certificates, exceptions, or exemptions granted as proof of compliance are legitimate.

In addition to identifying the administrative loopholes, a survey conducted for ARB by the College of Engineering-Center for Environmental Research and Technology (C-CERT) found an instantaneous unregistered rate of 3.4 percent in California. The survey also found that the unregistered rate diminishes after three months to less than one percent two years later.

Further examination is necessary to determine the potential emission reduction losses associated with non-compliance with registration requirements, necessary programmatic changes, impact on motorists, and cost effectiveness, including any potential loss of State revenue resulting from delayed vehicle registration compliance or administrative loopholes.

Restart Vehicle Retirement Program: DCA/BAR operates a Consumer Assistance Program (CAP) which offers motorists financial assistance to repair or retire vehicles that fail Smog Check. Income eligible motorists can qualify, as well as those individuals whose vehicles require inspection at a Test-Only station. Both the repair and retirement elements of the CAP have been successful, although the data suggests that the vehicle retirement element, which was suspended in January 2002 due to budget constraints, results in greater emission reductions for each dollar expended. Program data show:

- Between July 1, 2000 and June 30, 2003, DCA/BAR assisted in the repair of 60,636 vehicles (of which 26,118 or 43 percent failed Smog Check at "gross polluter" levels), at a total disbursement cost of over $21 million. These repairs

resulted in an estimated 1.6 tpd of cumulative[6] HC and NOx emission reductions in FY 2002/2003.

- Between July 1, 2000 and December 31, 2001, DCA/BAR retired 34,003 vehicles (of which 23,648 or 69 percent failed Smog Check at "gross polluter" levels), at a total disbursement cost of about $38 million. Retiring these vehicles resulted in an estimated 4.1 tpd of cumulative[7] HC and NOx emission reductions in FY 2002/2003.

After completing a competitive bid to buy and retire high-polluting vehicles, DCA/BAR plans to restart a vehicle retirement program in Spring 2004.

4.10 Potential Future Opportunities to Redesign Program

Two technologies, OBD II and remote sensing offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience of Smog Check. Both are the subject of studies designed to determine how best to use these technologies in the enhanced Smog Check program. These studies are underway, and results will be available in approximately one year. The technologies, and how they might be used in the Smog Check program, are discussed below. Once these studies are complete, staff will report and recommend further program design changes, if appropriate.

OBD II

OBD II is a diagnostic system installed on all new cars sold since the 1996 model year. The vehicle's computer continuously performs a diagnostic check of every emissions control system on the vehicle. For major systems such as the catalytic converter, evaporative, ignition, and fuel systems, the computer determines the performance of the system and evaluates whether emissions have increased beyond a threshold value (e.g., a 75 percent increase above normal levels). For the dozens of other sensors on the vehicle, the computer determines if the part is functioning and providing a reasonable value. All this information is available to the technician to help repair the vehicle.

Current Smog Check inspections include an automated evaluation of the OBD II system, using the test analyzer connected to the vehicle's computer. This is in addition to a test of the vehicle's emissions while driven on a dynamometer. The purpose of the study underway is to determine if the OBD II system is as effective in identifying vehicles with high emissions as the current emissions test. If the efficacy of OBD II were demonstrated, it would be possible to drop the dynamometer test for 1996 and newer cars. This would reduce the time to complete the test and lower its cost.

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[6] Emission reductions achieved by the repair assistance program are assumed to last for two years, until the next biennial inspection.

[7] Emission reductions achieved by the vehicle retirement program are assumed to last for three years, the average number of years the vehicle would have continued operating if it had not participated in the voluntary retirement program.

It may also be possible to use OBD II with modern electronic systems to increase the convenience for the motorist. For example, it may be possible to provide ATM-like devices where a motorist could hook up his car and have the Smog Check performed automatically. This concept is similar to the automated checkout now being used at some grocery and home improvement stores.

If the efficacy of OBD II as the sole inspection mechanism is determined, staff will report on opportunities to use it to improve the Smog Check program.

Remote Sensing

The second technology being evaluated is remote sensing. The RSD shoots a beam of infrared and ultraviolet light across the path of a moving vehicle and determines its tailpipe emissions. Limitations in using the device prevent it from being used to replace the current Smog Check emission test. However it may be possible to use RSD to improve the effectiveness and reduce the cost of Smog Check.

DCA/BAR and ARB are currently conducting a joint study to determine how best to use RSD in Smog Check. The results of the pilot study will be used to design an on-going RSD program. One question being evaluated in the study is whether RSD can be used to "clean screen" a vehicle and thus except it from its next biennial test. If RSD can identify vehicles with low emissions, costs would be reduced and consumer convenience improved. However, if the RSD incorrectly identifies a high emitting vehicle as clean, emission reductions would be lost. The study will quantify RSD's effectiveness and provide a technical basis for deciding its use.

RSD may also be effective in identifying gross emitting vehicles. For example, it could be used to identify gross emitters between biennial inspections and require their repair. It could also be used to randomly inspect vehicles older than 30 years that are exempt from biennial inspections. In both cases, emission reductions from the Smog Check program could be increased. The study will determine if RSD is accurate enough to be used to call in suspected gross emitters for an inspection at a Smog Check station.

5 Summary and Recommendations

Enhanced Smog Check is one of the most important emission reduction programs in California, alone providing 106 tpd HC and 76 tpd NOx reductions beyond the basic Smog Check program in 2002, as shown in Table 3.3. The cost effectiveness of the I/M program for the enhanced areas in California is estimated to be about $5,300 per ton of HC and NOx reduced. This cost effectiveness compares favorably to the typical cost effectiveness values for recently adopted ozone control measures of about $10,000 per ton. In addition, DCA/BAR has implemented several program improvements since 2001 that will provide additional emission reductions beyond those being achieved in 2002. With the additional HC and NOx emission reductions needed to meet the State and federal air quality standards, it is critical that California continue to achieve all the emission reductions feasible from the Smog Check program.

Within this context, DCA/BAR and ARB have evaluated the need for a comprehensive redesign of the program as directed in statute and have also evaluated improvements within the framework of the current program design. Staff has concluded that the current Smog Check program is working by delivering cost-effective emission reductions. However, there are opportunities to improve the program. Based on the program evaluation, the following potential improvements to the current program, within the framework of the current program design, have been identified:

- Clean screening the five and six year old vehicles most likely to pass their Smog Check inspections and offsetting any foregone emission reductions through other means. DCA/BAR has existing authority to except these vehicles from the biennial inspection, but a change in State law would be required to authorize DCA/BAR to collect a fee from any excepted vehicles and to use those fees toward programs that would offset the foregone emission reductions.

- Eliminating the existing 30-year rolling exemption and replacing it with an exemption for pre-1976 model year vehicles. This would require a change in State law.

- Inspecting older vehicles annually. This would require a change in State law.

- Inspecting high mileage vehicles annually. This would require a change in State law.

- Establishing more stringent after-repair cutpoints for vehicles that fail their Smog Check inspections to ensure that vehicles are fully repaired.

- Improving the enforcement of Smog Check program requirements by:

  - Authorizing funding to restore enforcement positions at DCA/BAR;
  - Establishing a specialized prosecution unit within the Attorney General's office to focus on Smog Check program cases (which would likely require direction from the Legislature); and

  - Granting statutory authority for DCA/BAR to retain Administrative Law Judges dedicated solely to conducting hearings associated with Smog Check disciplinary actions (which would require a change in State law).

- Adding a smoke test to the Smog Check inspection to aid in the enforcement of existing State law prohibiting the operation of smoking vehicles. This would require a change in State law.

- Excepting newer cars (two years old or less that are still under full warranty) from the requirement for a Smog Check upon change of ownership. This would require a change in State law.

In addition, there are promising technologies such as on-board diagnostics (OBD II) and remote sensing that may offer the opportunity to improve effectiveness, reduce costs, and improve consumer convenience. Both technologies are the subject of studies designed to determine how best to use these technologies in the enhanced Smog Check program. Once these studies are complete, DCA/BAR and ARB will report and recommend further program design changes.

Attachment J

Performance Measures

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q3 Report *(January - March 2013)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have developed a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q3 Total: 4,158

Q3 Monthly Average: 1,386

	January	February	March
Actual	1369	1247	1542

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q3 Average: 4 Days

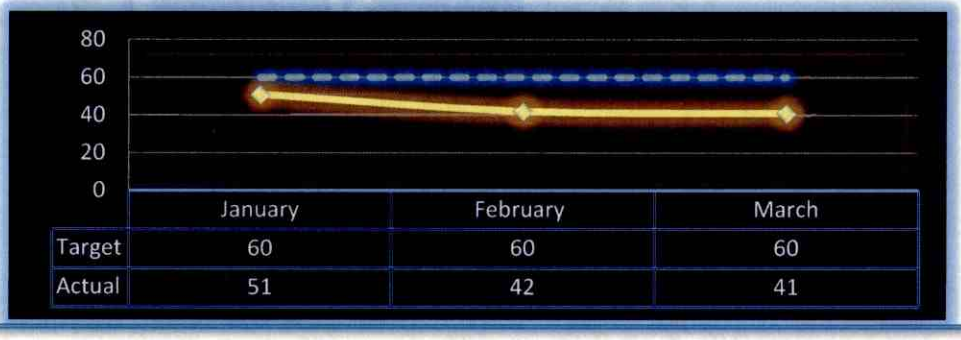
	January	February	March
Target	7	7	7
Actual	4	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does not include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q3 Average: 45 Days



	January	February	March
Target	60	60	60
Actual	51	42	41

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q3 Average: 454 Days

	January	February	March
Target	540	540	540
Actual	465	470	422

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q3 Average: 89%

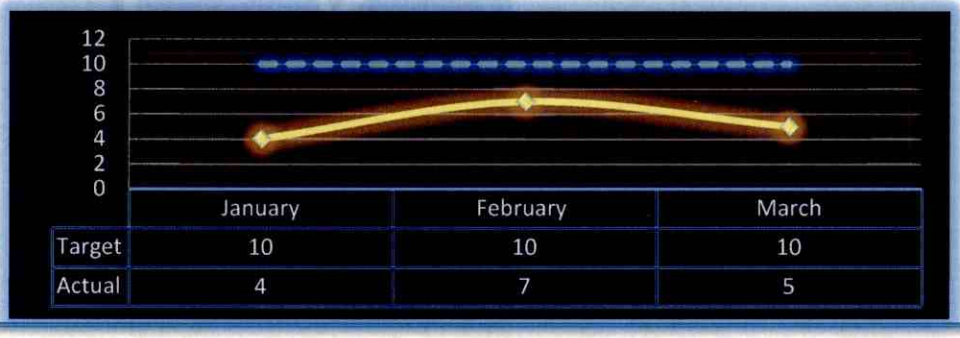
	January	February	March
Target	88%	85%	85%
Actual	94%	87%	87%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q3 Average: 5 Days



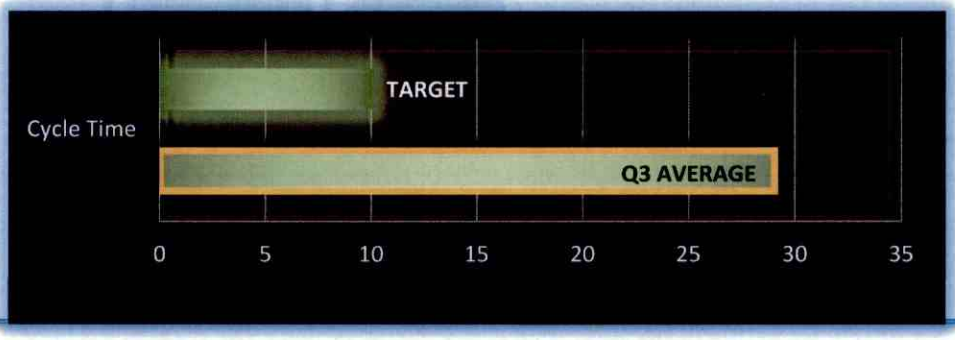
	January	February	March
Target	10	10	10
Actual	4	7	5

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q3 Average: 29 Days



Department of Consumer Affairs
Bureau of
Automotive Repair

Performance Measures

Q2 Report *(October - December 2012)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

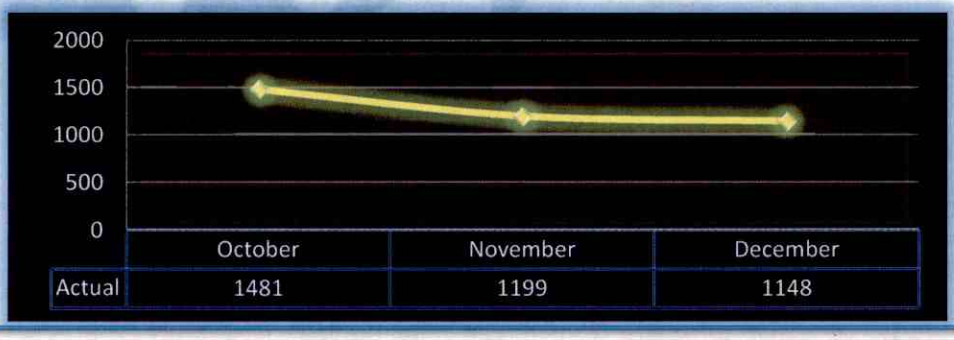
These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q2 Total: 3,828

Q2 Monthly Average: 1,276



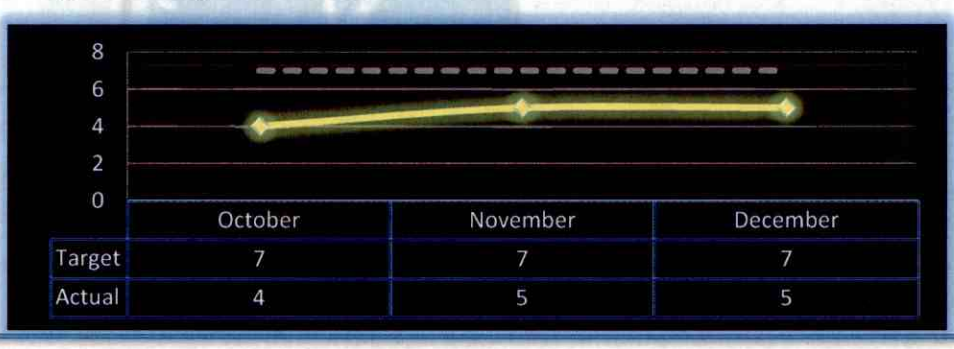
	October	November	December
Actual	1481	1199	1148

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q2 Average: 4 Days



	October	November	December
Target	7	7	7
Actual	4	5	5

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q2 Average: 51 Days

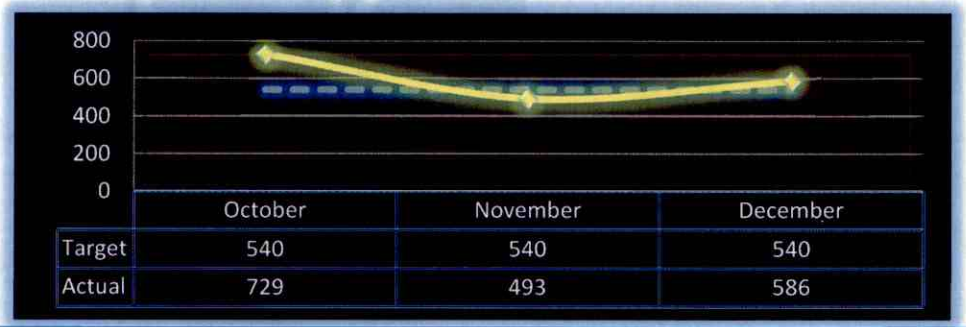
	October	November	December
Target	60	60	60
Actual	49	51	54

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q2 Average: 603 Days



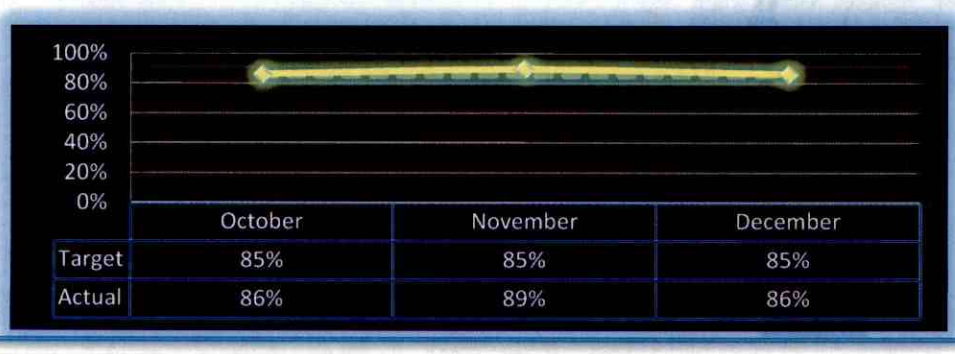
	October	November	December
Target	540	540	540
Actual	729	493	586

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q2 Average: 87%



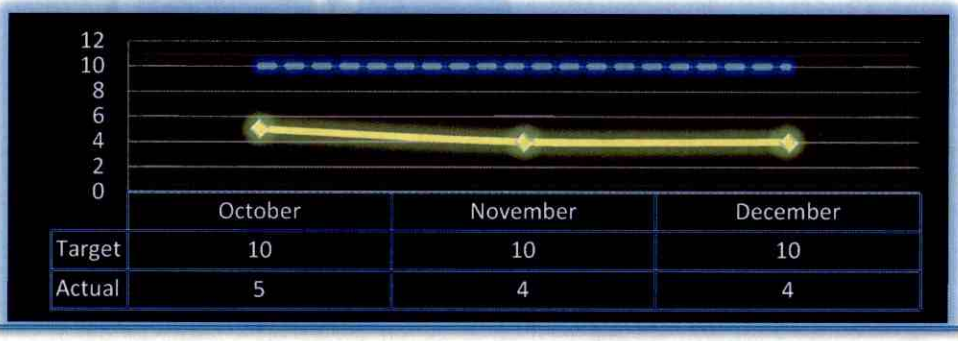
	October	November	December
Target	85%	85%	85%
Actual	86%	89%	86%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q2 Average: 4 Days



	October	November	December
Target	10	10	10
Actual	5	4	4

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q2 Average: N/A

The Bureau did not report any violations this quarter.

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q1 Report *(July - September 2012)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

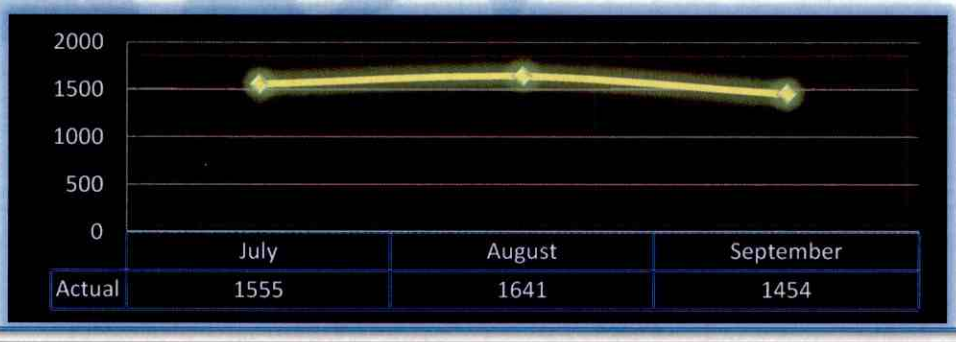
These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q1 Total: 4,650

Q1 Monthly Average: 1,550



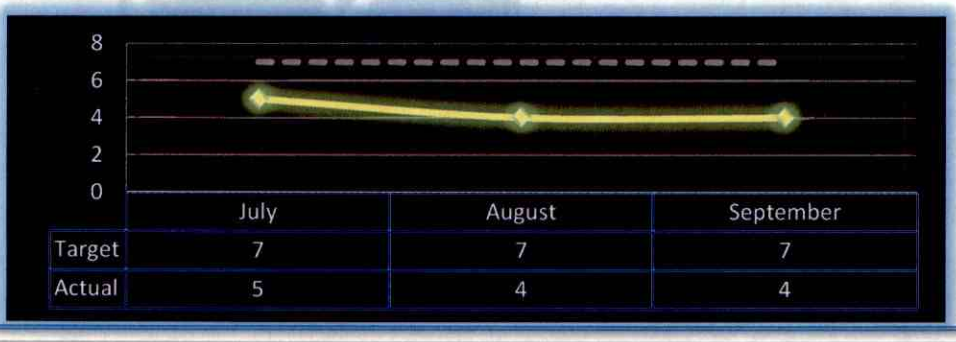
	July	August	September
Actual	1555	1641	1454

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q1 Average: 4 Days



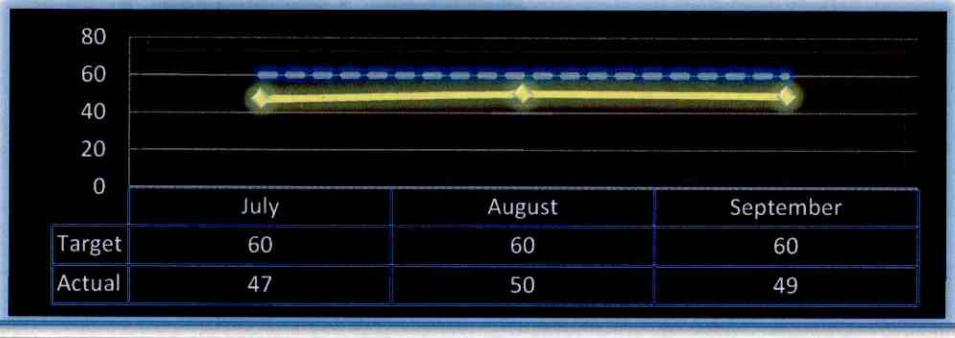
	July	August	September
Target	7	7	7
Actual	5	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does not include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q1 Average: 49 Days



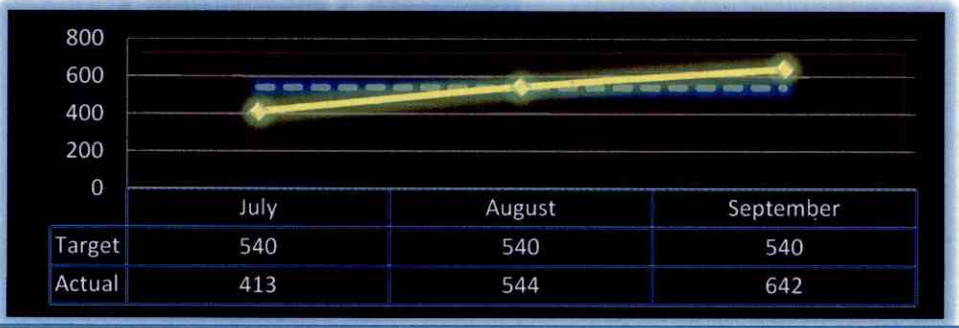
	July	August	September
Target	60	60	60
Actual	47	50	49

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q1 Average: 569 Days



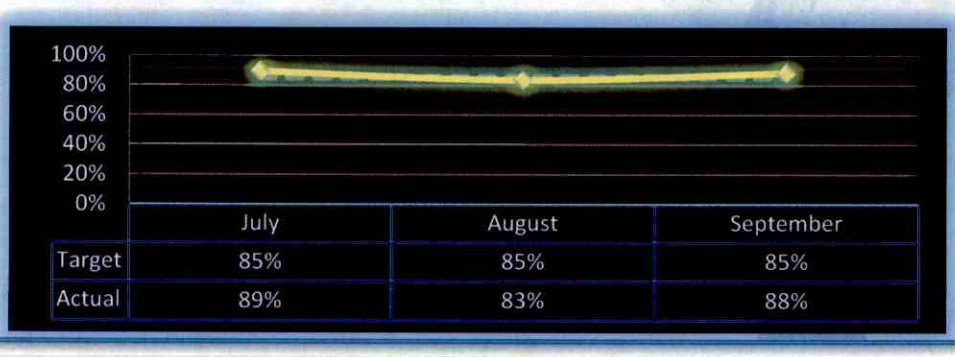
	July	August	September
Target	540	540	540
Actual	413	544	642

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q1 Average: 86%



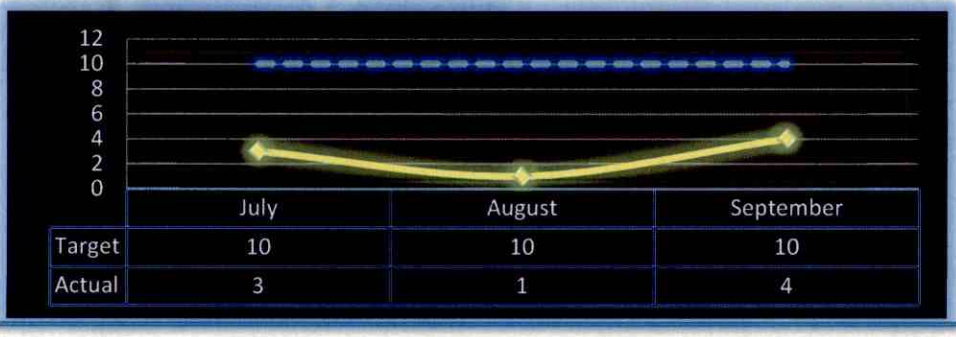
	July	August	September
Target	85%	85%	85%
Actual	89%	83%	88%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q1 Average: 3 Days



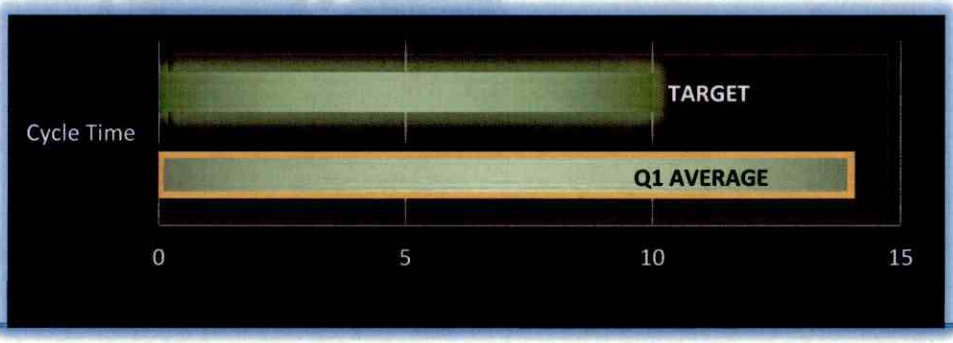
	July	August	September
Target	10	10	10
Actual	3	1	4

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q1 Average: 14 Days



Department of Consumer Affairs

Bureau of Automotive Repair

Performance Measures

Annual Report *(2011 – 2012 Fiscal Year)*

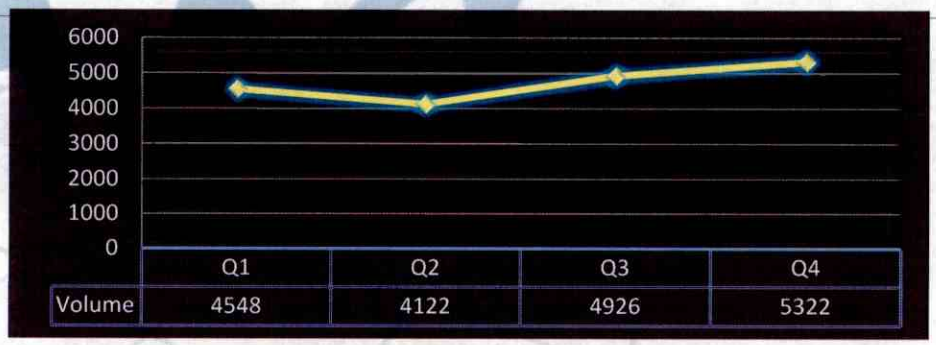
To ensure stakeholders can review the Bureau's progress in meeting its enforcement goals and targets, we have developed a transparent system of performance measurement. These measures are posted publicly on a quarterly basis.

This annual report represents the culmination of the four quarters worth of data.

Volume

Number of complaints and convictions received.

The Bureau had an annual total of 18,918 this fiscal year.

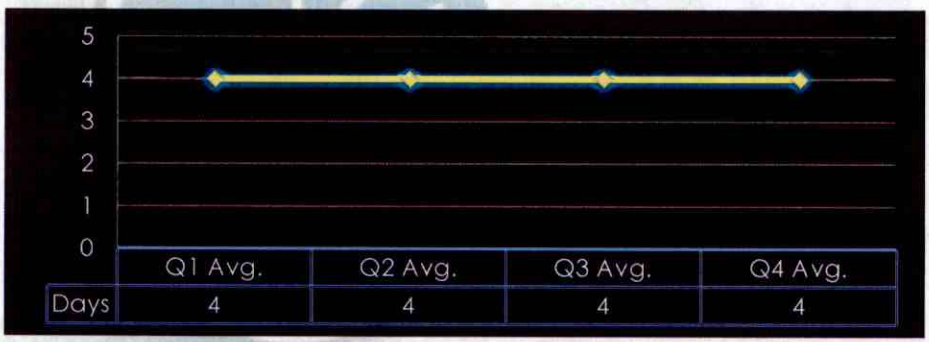


	Q1	Q2	Q3	Q4
Volume	4548	4122	4926	5322

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

The Bureau has set a target of 7 days for this measure.

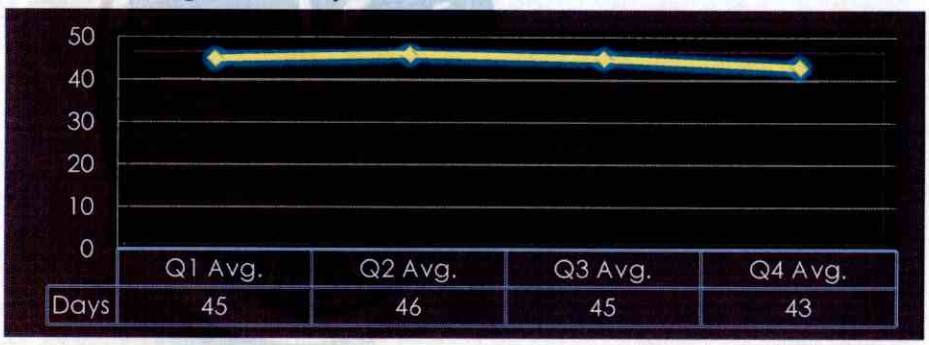


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	4	4	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does not include cases sent to the Attorney General or other forms of formal discipline.

The Bureau has set a target of 60 days for this measure.

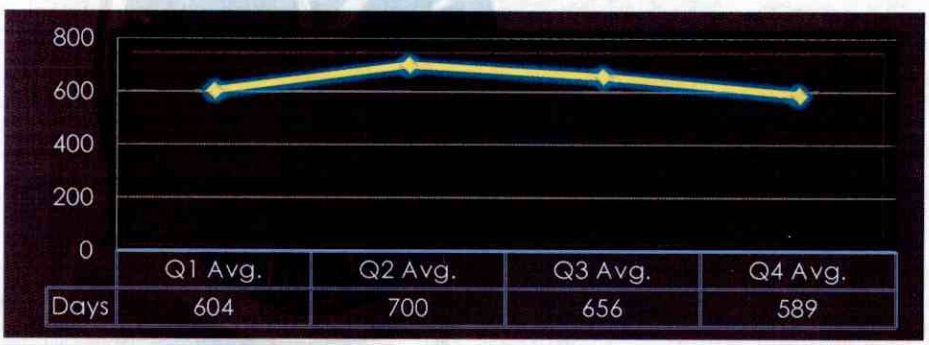


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	45	46	45	43

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline. (Includes intake and investigation by the Bureau, and prosecution by the AG)

The Bureau has set a target of 540 days for this measure.

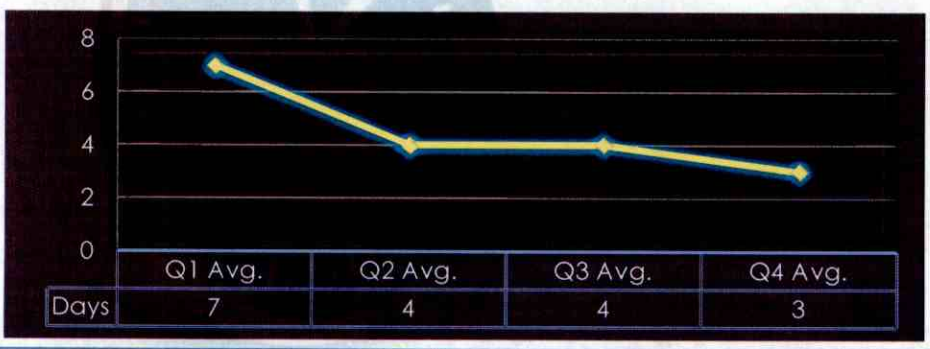


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	604	700	656	589

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

The Bureau has set a target of 10 days for this measure.

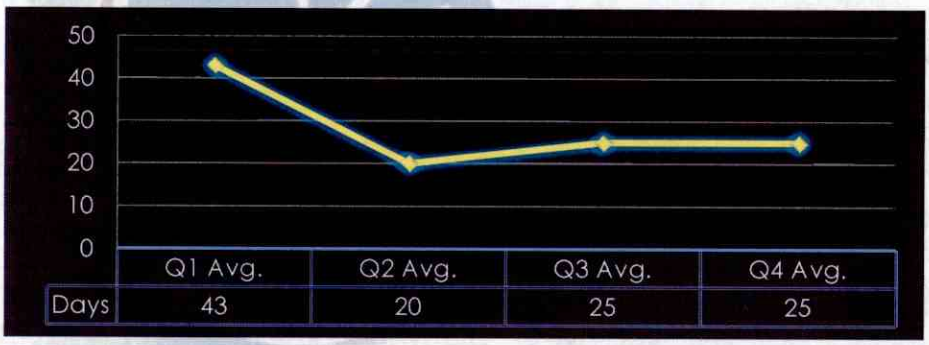


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	7	4	4	3

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

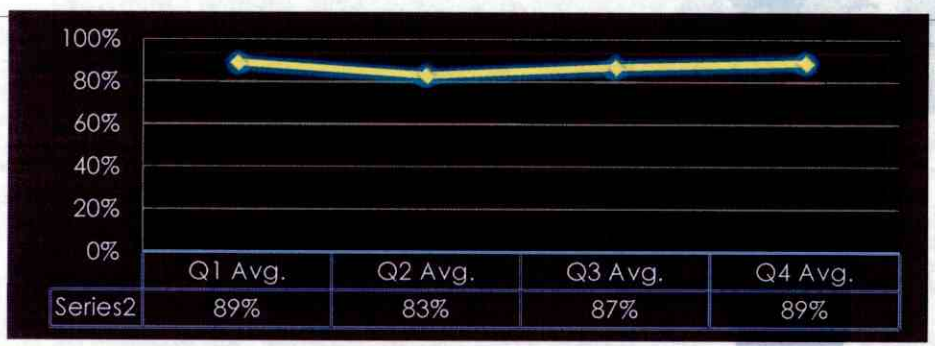
The Bureau has set a target of 10 days for this measure.



Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

The Bureau has set a target of 85% satisfaction for this measure.



Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q4 Report *(April - June 2012)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q4 Total: 5,322

Q4 Monthly Average: 1,774

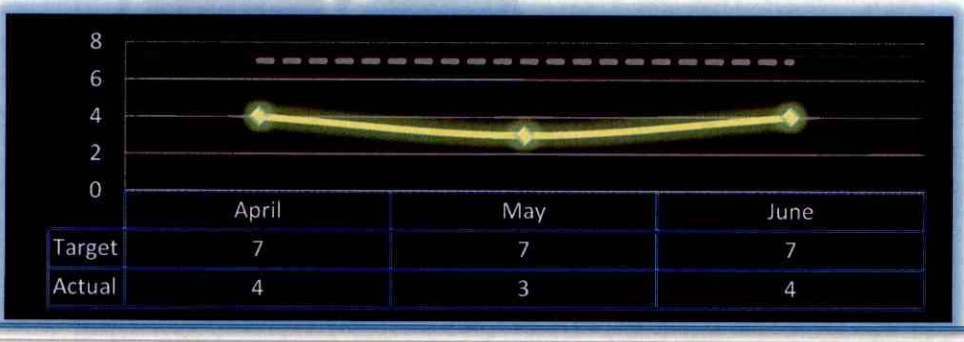
	April	May	June
Actual	1721	1827	1774

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q4 Average: 4 Days



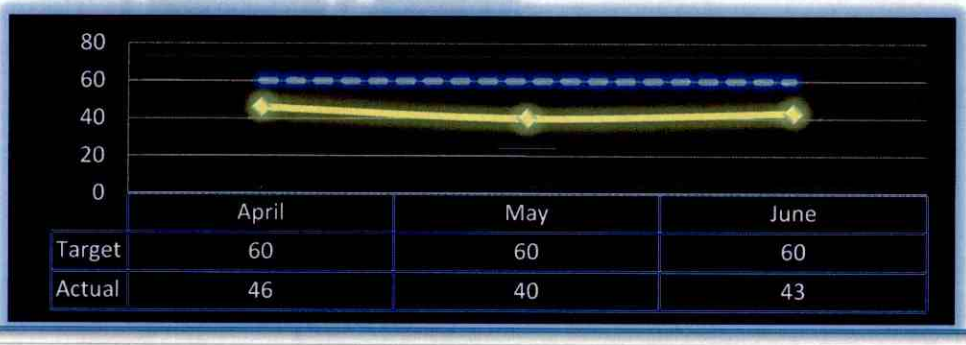
	April	May	June
Target	7	7	7
Actual	4	3	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q4 Average: 43 Days



	April	May	June
Target	60	60	60
Actual	46	40	43

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q4 Average: 589 Days

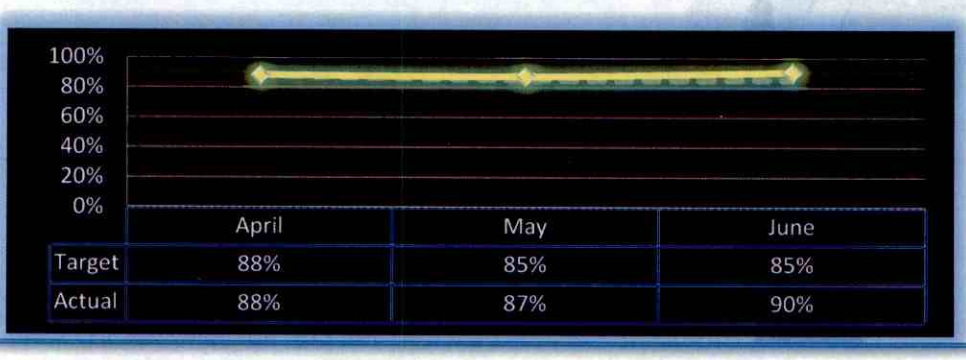
	April	May	June
Target	540	540	540
Actual	564	681	522

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 88%

Q4 Average: 89%



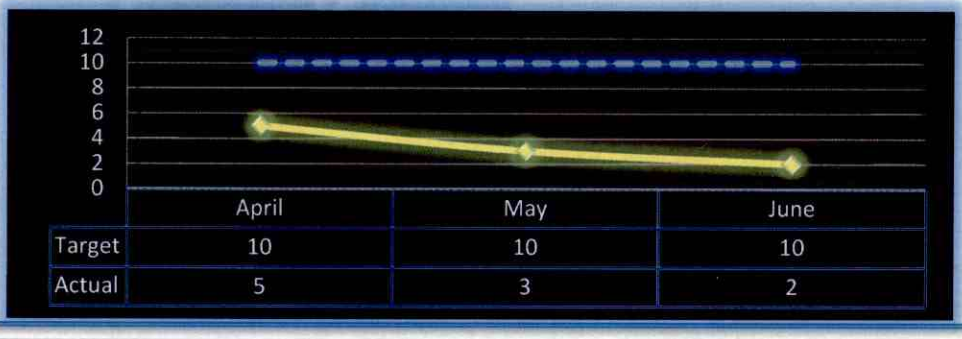
	April	May	June
Target	88%	85%	85%
Actual	88%	87%	90%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q4 Average: 3 Days



	April	May	June
Target	10	10	10
Actual	5	3	2

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q4 Average: 25 Days

Department of Consumer Affairs
Bureau of
Automotive Repair

Performance Measures

Q3 Report *(January - March 2012)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

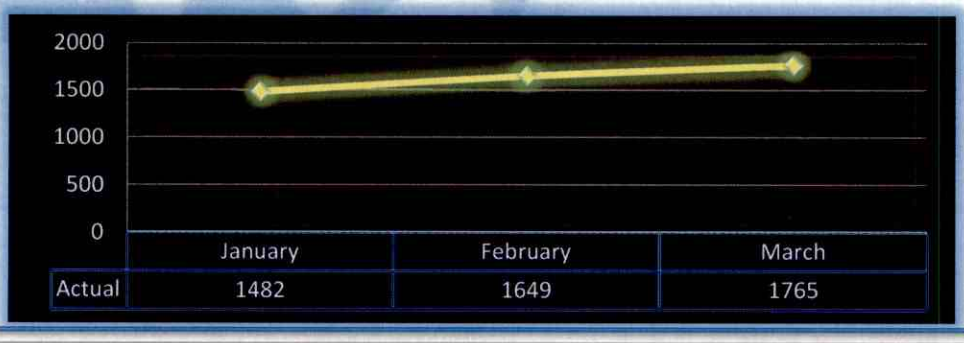
These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q3 Total: 4,896

Q3 Monthly Average: 1,642

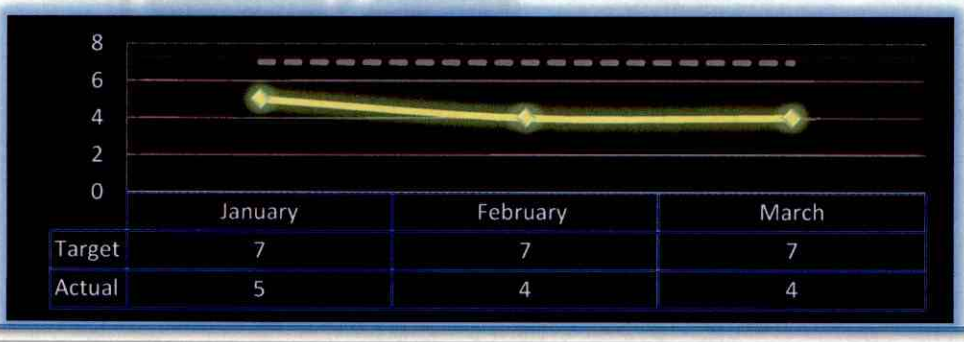


Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q3 Average: 4 Days

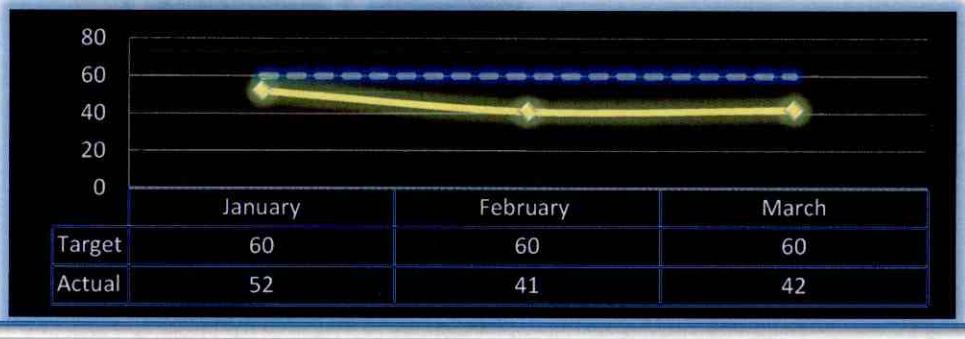


Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q3 Average: 45 Days



	January	February	March
Target	60	60	60
Actual	52	41	42

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q3 Average: 656 Days

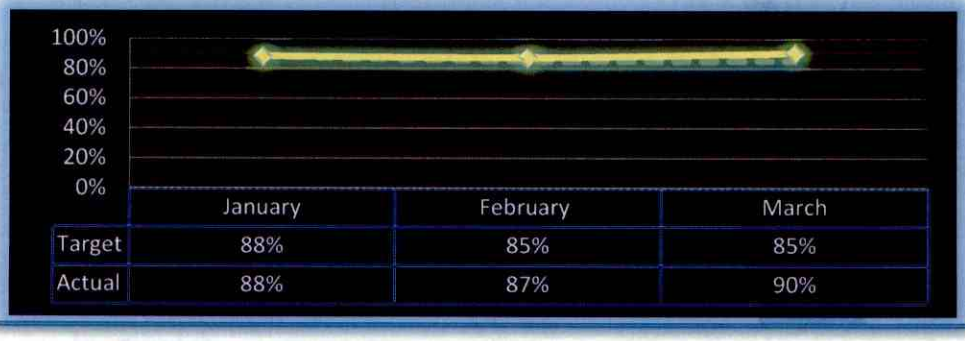
	January	February	March
Target	540	540	540
Actual	611	676	682

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q3 Average: 88%



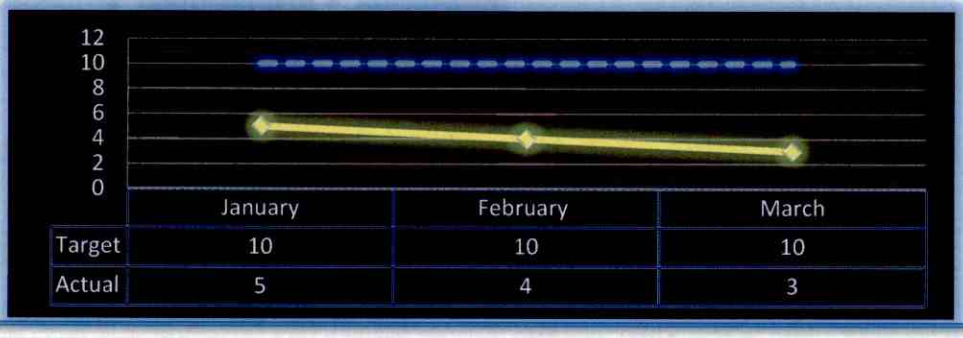
	January	February	March
Target	88%	85%	85%
Actual	88%	87%	90%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q3 Average: 4 Days



	January	February	March
Target	10	10	10
Actual	5	4	3

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q3 Average: 25 Days

Department of Consumer Affairs
Bureau of
Automotive Repair

Performance Measures

Q2 Report *(October - December 2011)*

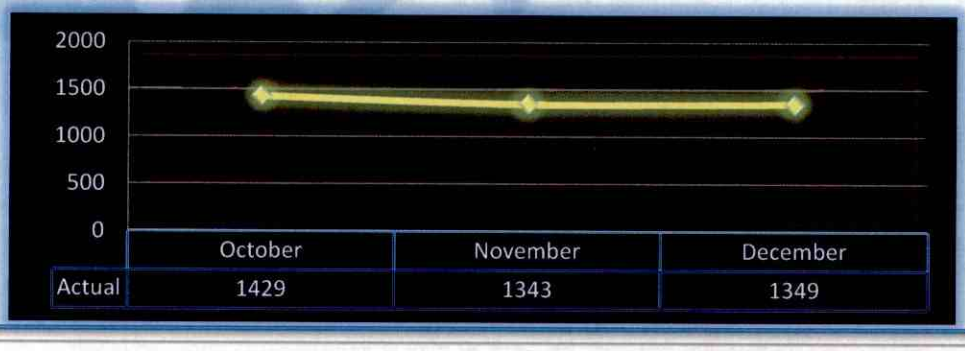
To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q2 Total: 4,121
Q2 Monthly Average: 1,374



	October	November	December
Actual	1429	1343	1349

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days
Q2 Average: 4 Days

	October	November	December
Target	7	7	7
Actual	4	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q2 Average: 46 Days

	October	November	December
Target	60	60	60
Actual	46	46	46

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q2 Average: 700 Days

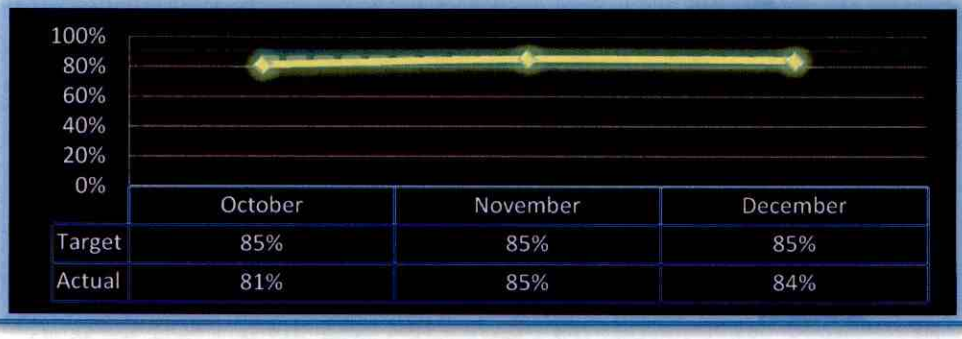
	October	November	December
Target	540	540	540
Actual	721	685	694

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q2 Average: 83%



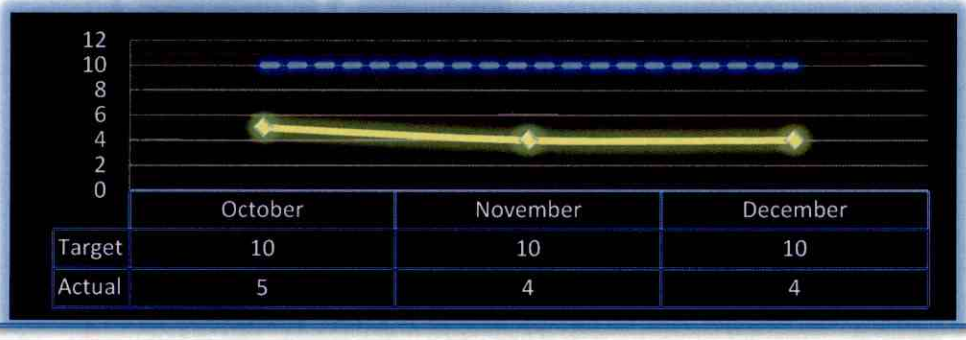
	October	November	December
Target	85%	85%	85%
Actual	81%	85%	84%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q2 Average: 4 Days



	October	November	December
Target	10	10	10
Actual	5	4	4

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q2 Average: 20 Days

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q1 Report *(July - September 2011)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have developed a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q1 Total: 4,548

Q1 Monthly Average: 1,516

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

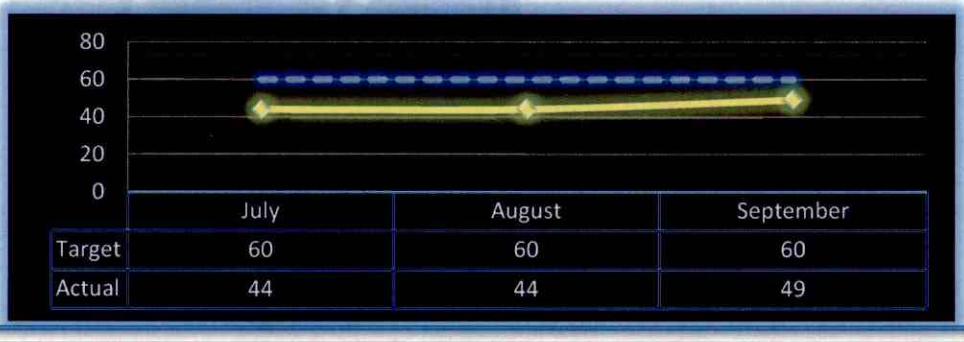
Q1 Average: 4 Days

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q1 Average: 45 Days



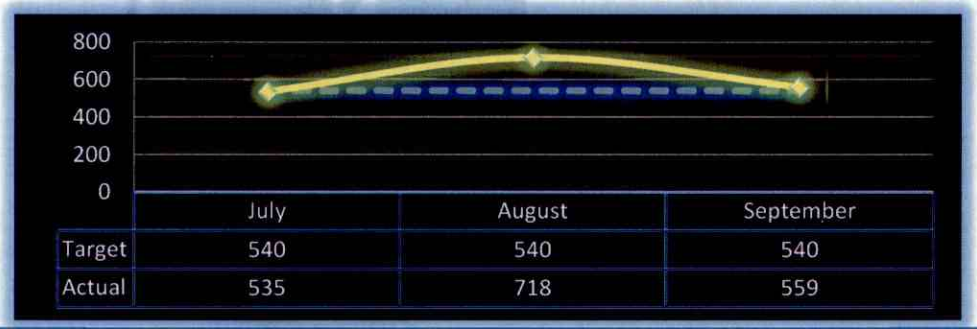
	July	August	September
Target	60	60	60
Actual	44	44	49

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q1 Average: 604 Days



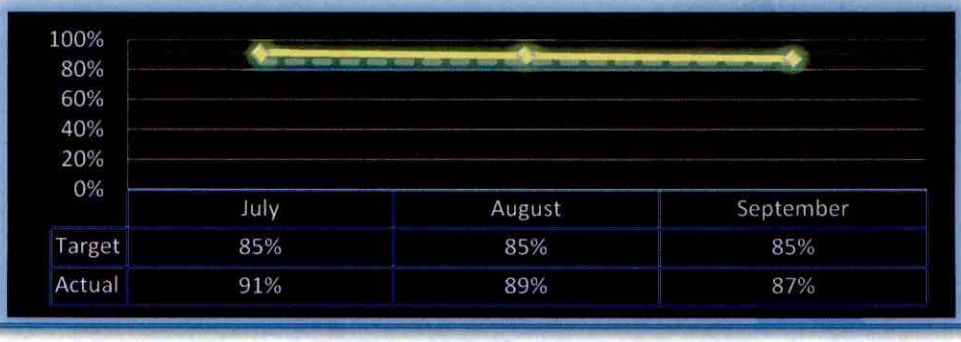
	July	August	September
Target	540	540	540
Actual	535	718	559

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q1 Average: 89%



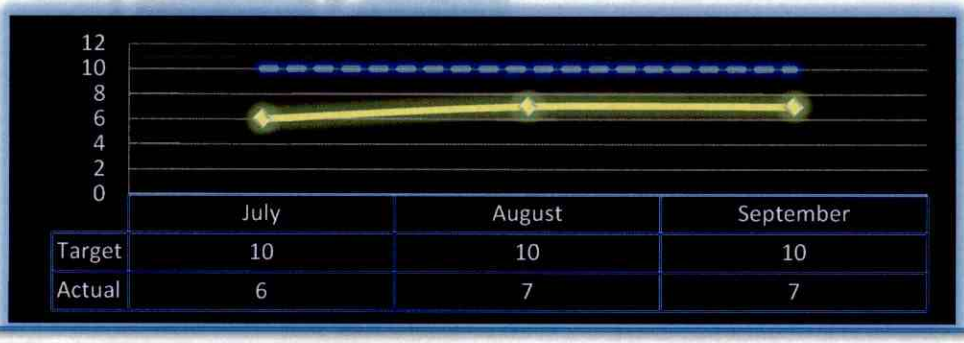
	July	August	September
Target	85%	85%	85%
Actual	91%	89%	87%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q1 Average: 7 Days



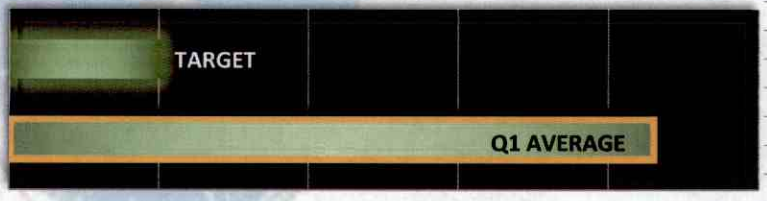
	July	August	September
Target	10	10	10
Actual	6	7	7

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q1 Average: 43 Days



Department of Consumer Affairs

Bureau of Automotive Repair

Performance Measures

Annual Report *(2010 – 2011 Fiscal Year)*

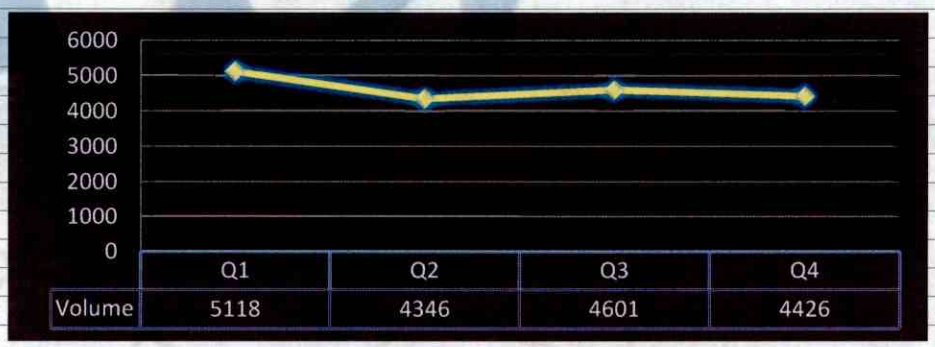
To ensure stakeholders can review the Bureau's progress in meeting its enforcement goals and targets, we have developed a transparent system of performance measurement. These measures are posted publicly on a quarterly basis.

This annual report represents the culmination of the first four quarters worth of data.

Volume

Number of complaints and convictions received.

The Bureau had an annual total of 18,491 this fiscal year.

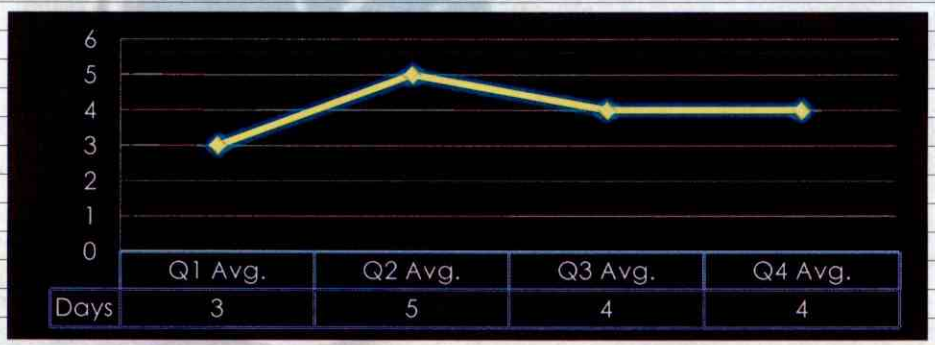


	Q1	Q2	Q3	Q4
Volume	5118	4346	4601	4426

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

The Bureau has set a target of 7 days for this measure.

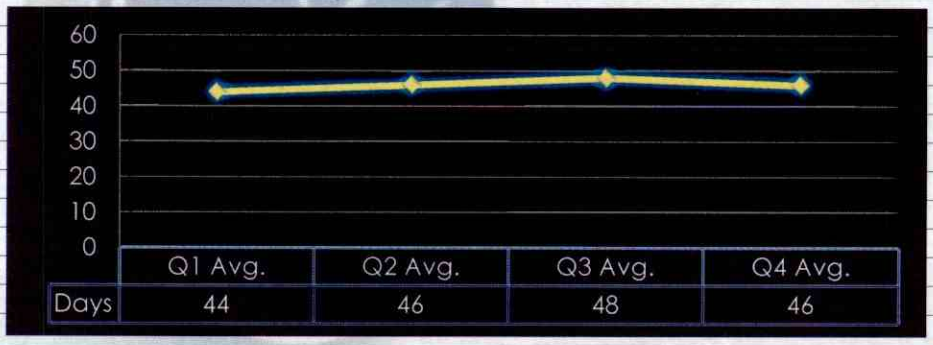


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	3	5	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

The Bureau has set a target of 60 days for this measure.

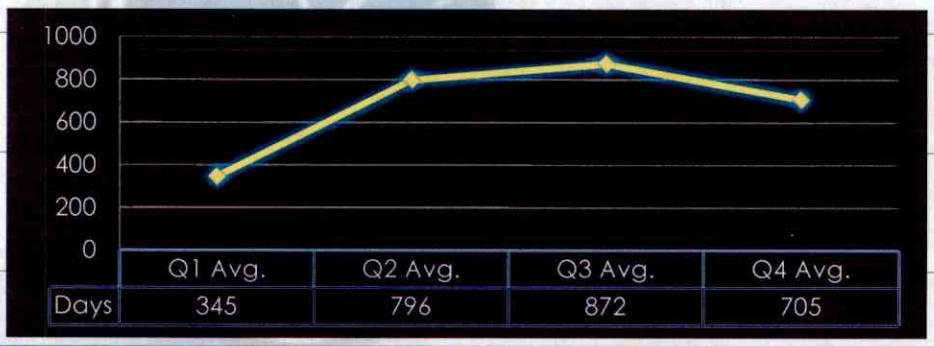


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	44	46	48	46

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline. (Includes intake and investigation by the Bureau, and prosecution by the AG)

The Bureau has set a target of 540 days for this measure.

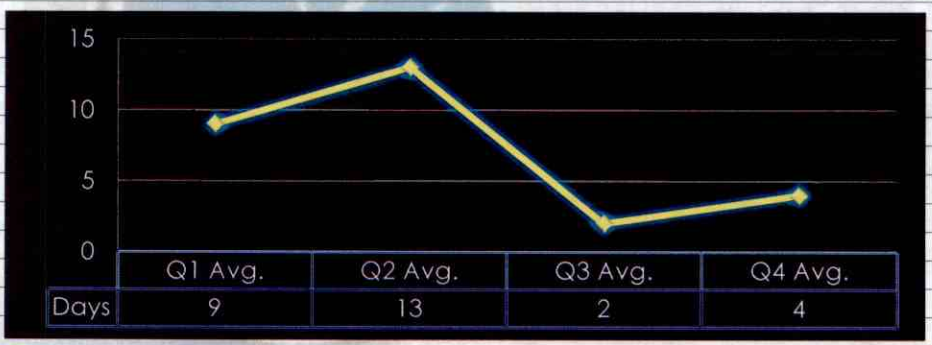


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	345	796	872	705

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

The Bureau has set a target of 10 days for this measure.

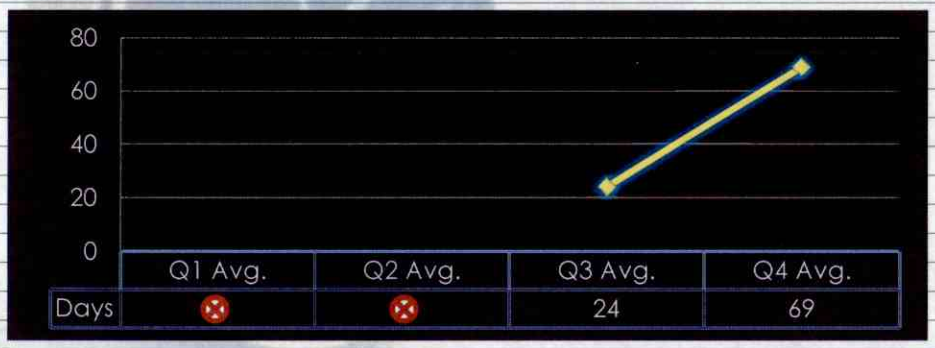


	Q1 Avg.	Q2 Avg.	Q3 Avg.	Q4 Avg.
Days	9	13	2	4

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

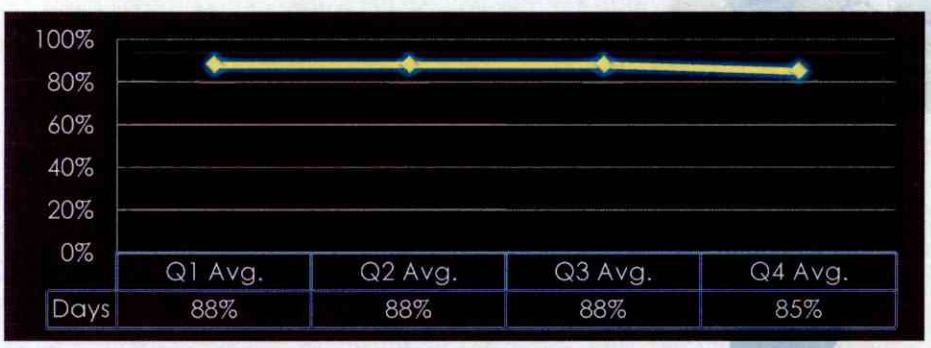
The Bureau has set a target of 10 days for this measure.



Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

The Bureau has set a target of 85% satisfaction for this measure.



Department of Consumer Affairs
Bureau of
Automotive Repair

Performance Measures

Q4 Report *(April - June 2011)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q4 Total: 4,426

Q4 Monthly Average: 1,475

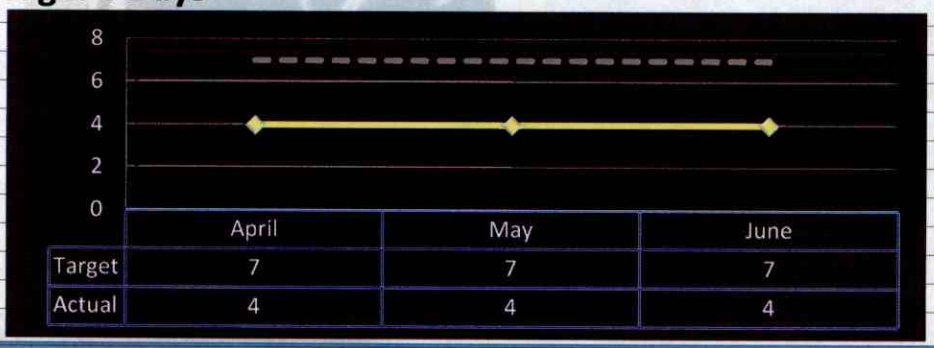
	April	May	June
Actual	1575	1380	1471

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q4 Average: 4 Days



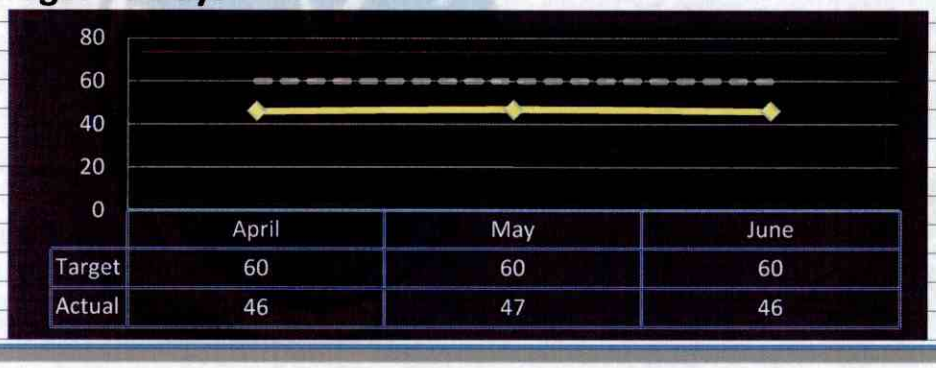
	April	May	June
Target	7	7	7
Actual	4	4	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q4 Average: 46 Days



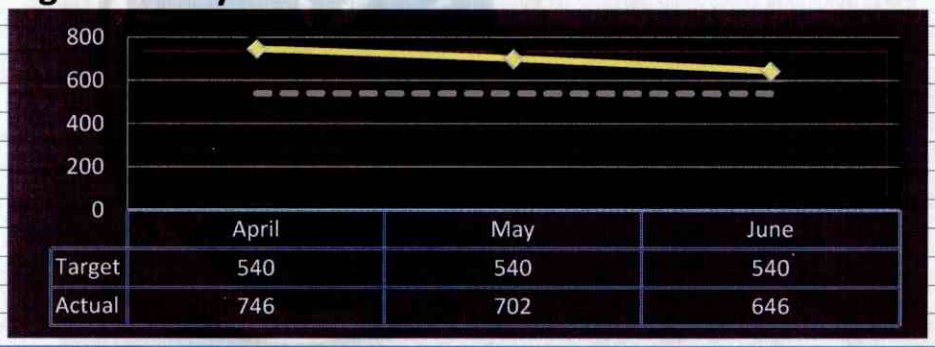
	April	May	June
Target	60	60	60
Actual	46	47	46

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q4 Average: 705 Days



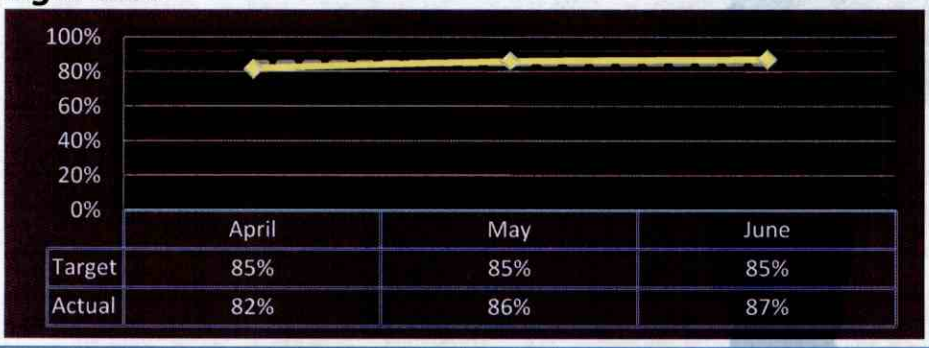
	April	May	June
Target	540	540	540
Actual	746	702	646

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q4 Average: 85%



	April	May	June
Target	85%	85%	85%
Actual	82%	86%	87%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q4 Average: 4 Days

	April	May	June
Target	10	10	10
Actual	3	5	5

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q4 Average: 69 Days

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q3 Report *(January - March 2011)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

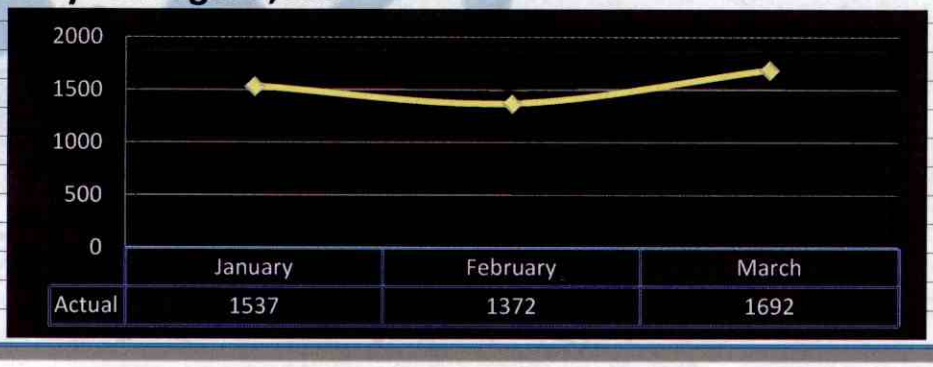
These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q3 Total: 4,601

Q3 Monthly Average: 1,533



Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

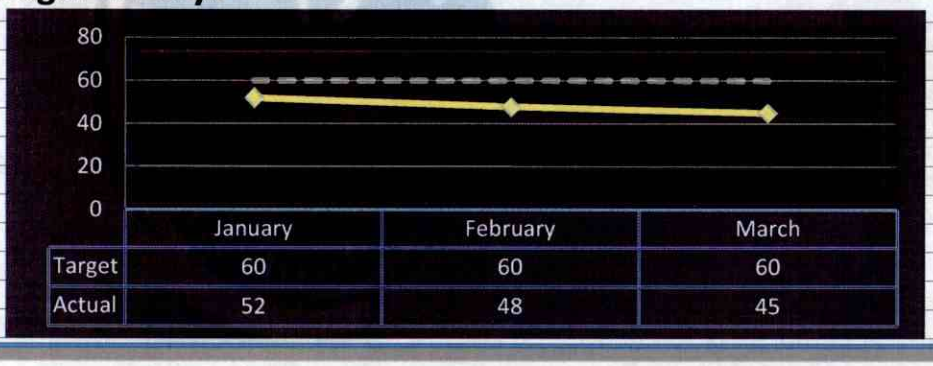
Q3 Average: 4 Days

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q3 Average: 48 Days



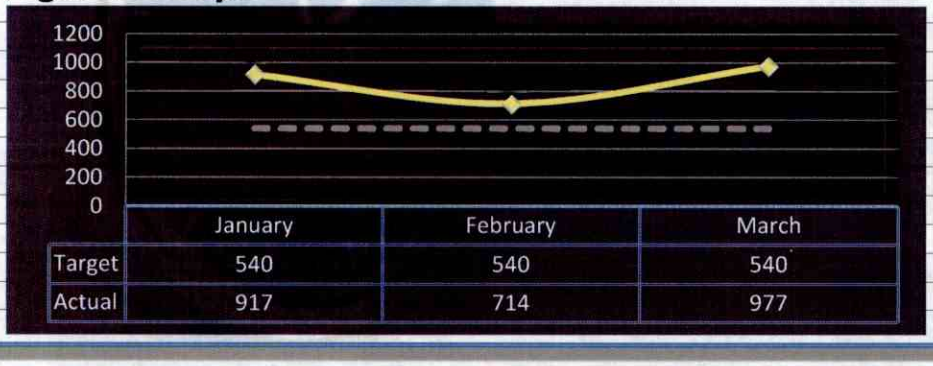
	January	February	March
Target	60	60	60
Actual	52	48	45

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q3 Average: 872 Days



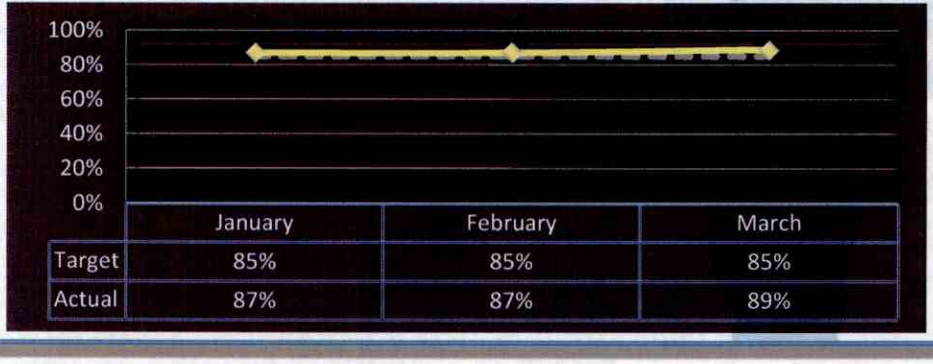
	January	February	March
Target	540	540	540
Actual	917	714	977

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q3 Average: 88%



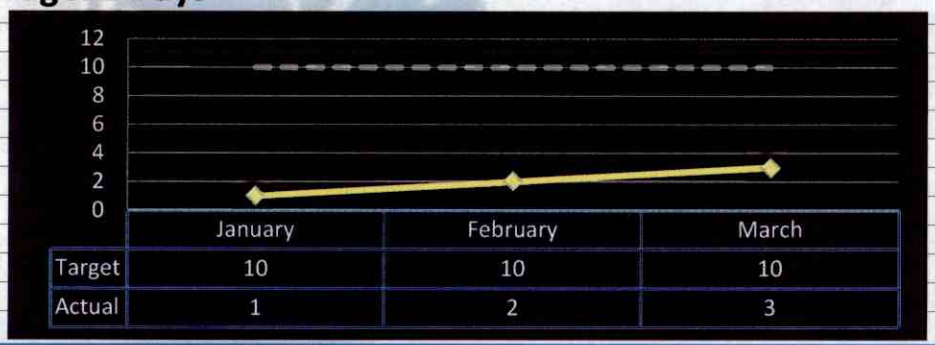
	January	February	March
Target	85%	85%	85%
Actual	87%	87%	89%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q3 Average: 2 Days



	January	February	March
Target	10	10	10
Actual	1	2	3

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q3 Average: 24 Days

	January	February	March
Target	10	10	10
Actual	17	8	81

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q2 Report *(October - December 2010)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have devebped a transparent system of performance measurement.

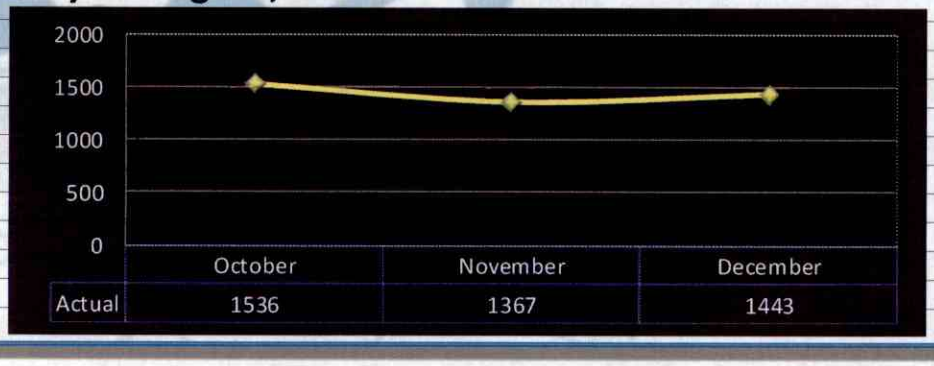
These measures will be posted publicly on a quarterly basis.

Volume

Number of complaints received.

Q2 Total: 4,346

Q2 Monthly Average: 1,449



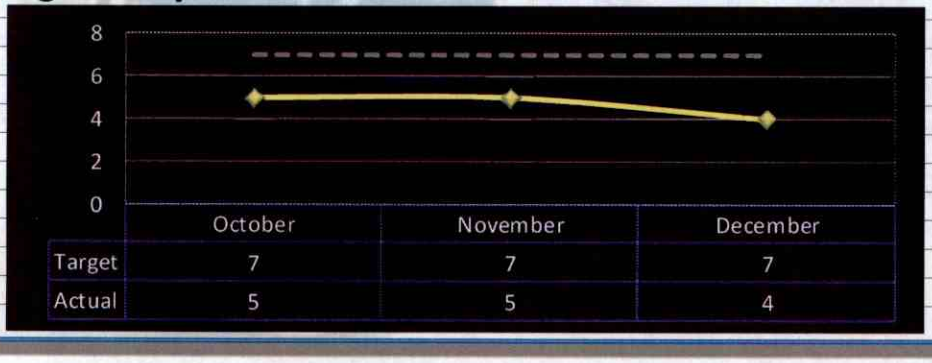
	October	November	December
Actual	1536	1367	1443

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q2 Average: 5 Days



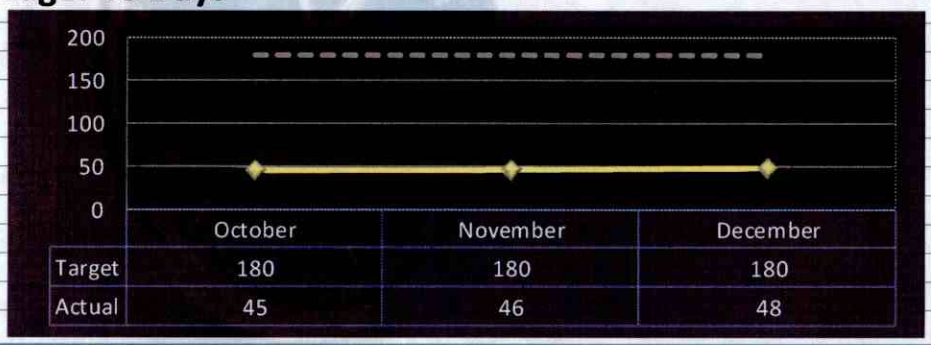
	October	November	December
Target	7	7	7
Actual	5	5	4

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does <u>not</u> include cases sent to the Attorney General or other forms of formal discipline.

Target: 180 Days

Q2 Average: 46 Days



	October	November	December
Target	180	180	180
Actual	45	46	48

Formal Discipline

Average number of days to complete the entire enforcement process for cases resulting in formal discipline (Includes intake and investigation by the Bureau and prosecution by the AG).

Target: 540 Days

Q2 Average: 796 Days

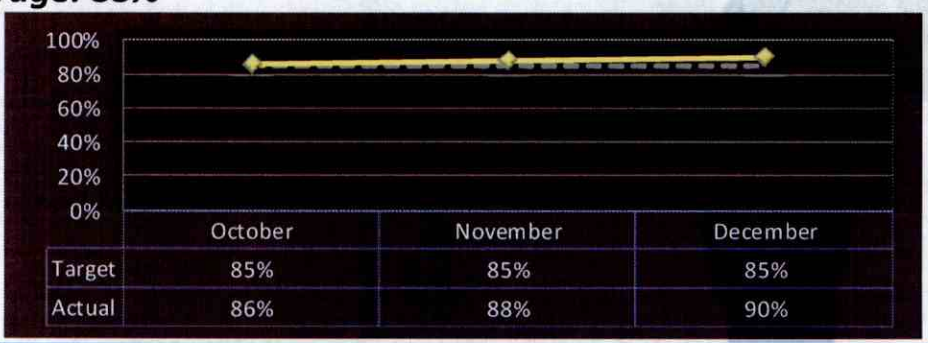
	October	November	December
Target	540	540	540
Actual	609	849	1088

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q2 Average: 88%



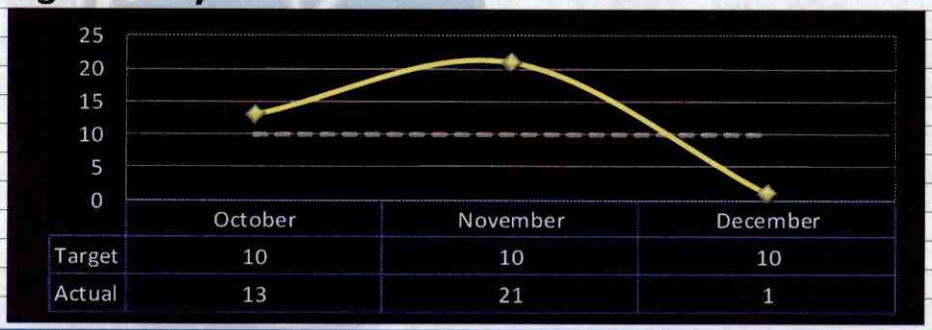
	October	November	December
Target	85%	85%	85%
Actual	86%	88%	90%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q2 Average: 13 Days



	October	November	December
Target	10	10	10
Actual	13	21	1

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q2 Average: N/A

The Bureau did not handle any probation violations this quarter.

Department of Consumer Affairs

Bureau of
Automotive Repair

Performance Measures

Q1 Report *(July - Sept 2010)*

To ensure stakeholders can review the Bureau's progress toward meeting its enforcement goals and targets, we have developed a transparent system of performance measurement.

These measures will be posted publicly on a quarterly basis. In future reports, additional measures, such as complaint efficiency, will also be added. These additional measures are being collected internally at this time and will be released once sufficient data is available.

Volume

Number of complaints received.*

Q1 Total: 5,118

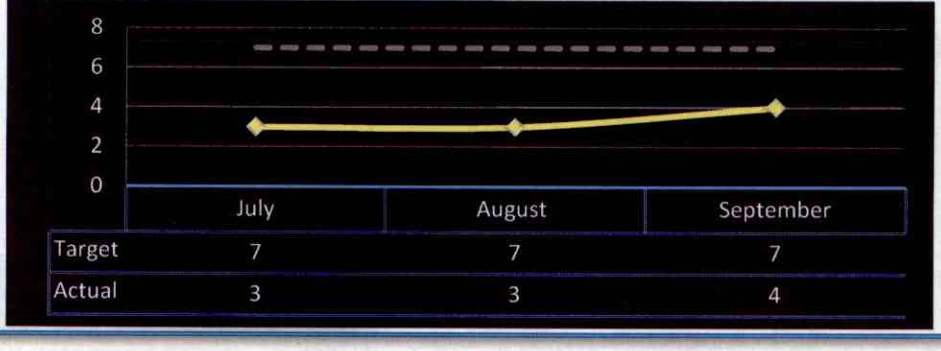
Q1 Average: 1,706

Intake

Average cycle time from complaint receipt, to the date the complaint was assigned to an investigator.

Target: 7 Days

Q1 Average: 3 Days



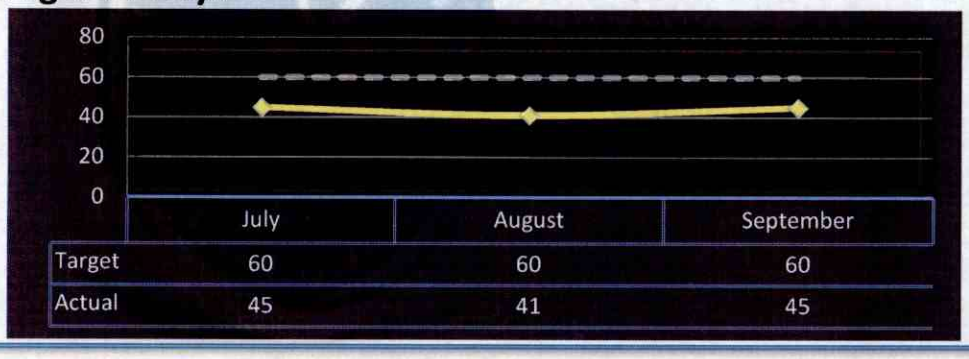
***"Complaints" in these measures include consumer complaints and internally generated complaints.**

Intake & Investigation

Average cycle time from complaint receipt to closure of the investigation process. Does not include cases sent to the Attorney General or other forms of formal discipline.

Target: 60 Days

Q1 Average: 44 Days



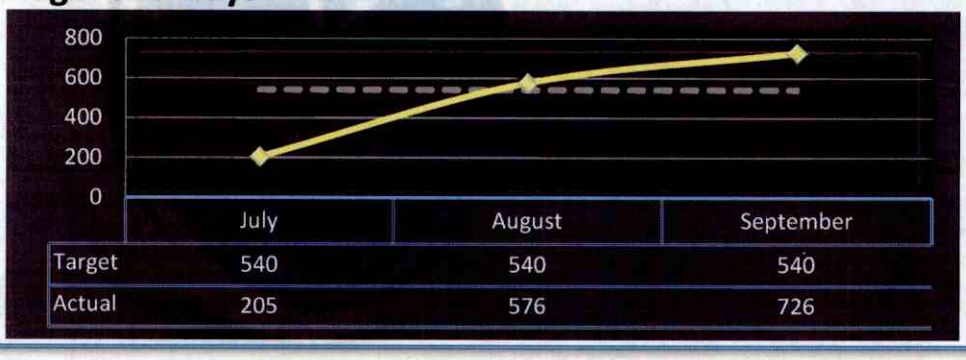
	July	August	September
Target	60	60	60
Actual	45	41	45

Formal Discipline

Average cycle time from complaint receipt to closure, for cases sent to the Attorney General or other forms of formal discipline.

Target: 540 Days

Q1 Average: 345 Days



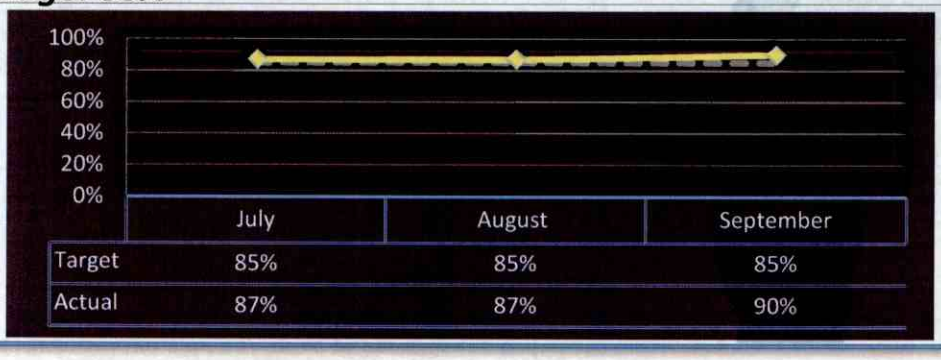
	July	August	September
Target	540	540	540
Actual	205	576	726

Consumer Satisfaction

Percentage of consumer survey responses indicating satisfaction with the complaint process.

Target: 85%

Q1 Average: 88%



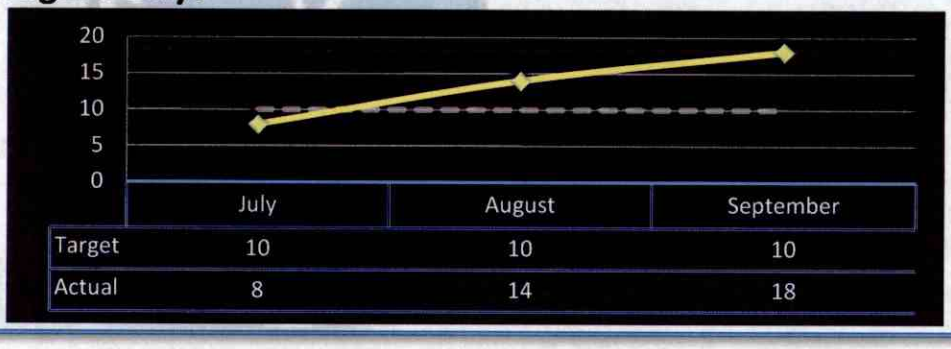
	July	August	September
Target	85%	85%	85%
Actual	87%	87%	90%

Probation Intake

Average number of days from monitor assignment, to the date the monitor makes first contact with the probationer.

Target: 10 Days

Q1 Average: 9 Days



	July	August	September
Target	10	10	10
Actual	8	14	18

Probation Violation Response

Average number of days from the date a violation of probation is reported, to the date the assigned monitor initiates appropriate action.

Target: 10 Days

Q1 Average: N/A

The Bureau did not have any probation violations this quarter.

Attachment K

Schedule of Workload Revenue

VIRF Schedule of Workload and Revenue

DESCRIPTION	EXPLANATION/SIGNIFICANT DATES (Biennial, Annual, every other year, cyclical, etc.)	CURRENT FEE	H&S CODE	B&P CODE	VEHICLE CODE	CALSTARS	REGULATION	COMMENTS
Advanced Emission Specialist (Smog Check)	Biennially			9882(a)			3340.29(a)	
Automotive Repair Dealership	Initial	$200.00		9886.3			3351.1	Not to exceed $200.00
Automotive Repair Dealership	Annual Renewal	$200.00		9886.3			3351.1	Not to exceed $200.00
Basic Area Smog Check Technician	Biennially			9882(a)			3340.29(a)	
Brake Adjuster	Four year renewal cycle			9887.2			3306 & 3310(d)	
Brake Certificate Book	(Other Regulatory Fees)	$175.00		9889.19			3321	Not to produce a total estimated revenue which, together with license fees and certification fees charged pursuant to section 9886.3, 9887.2, and 9887.3, is in excess of the estimated total cost to the bureau for the administration of this chapter.
Delinquent ARD		$250.00		9886.3			3351.1	Not to exceed $250
Delinquent Lamp & Brake Inst/Adj		$7.50		9887.2			3306	
Delinquent Lamp & Brake Station		$7.50		9887.2			3306	
Delinquent Smog Station		$150.00	44034				3340.1	
Dishonored Check Fee				2895.1				
Duplicate registration/license	(Other Regulatory Fees)	$2.00		9887.3			3351.1	Statute specifies fee amount of $2.00
ESCHEAT/ Rev cancelled warrants	Annual					161000.00		State Administrative Manual Section 8281. State Controller's warrants that remain uncashed for one year will be cancelled by the SCO and credited to an escheat revenue account in the fund from which they were drawn.
Fee for issuance of duplicate certificate	(Other Regulatory Fees)			122				Statute specifies that the amount charged may be sufficient to cover costs associated with issuance of a duplicate license, but not to exceed $25.00
Improper or Partial Pretest	(Administrative Fine)	$250 - $1000	44011.3					
Improper Test Procedures	(Administrative Fine)	$1000 - $5000	44012					
Smog Check Advertising	(Administrative Fine)	$750 - $3000	44014.4					
Test-Only Facility Standards	(Administrative Fine)	$750 - $3000	44014.5					
Improper Certificate Issuance	(Administrative Fine)	$1000 - $5000	44015					
Improper Certificate Issuance (New Vehicle/Non ARB Certified)	(Administrative Fine)	$1000 - $5000	44015.5					
Test and Repair Procedures/Specifications	(Administrative Fine)	$1000 - $5000	44016					
Repair Cost Limits/Waivers	(Administrative Fine)	$1000 - $5000	44017					
Required Postings	(Administrative Fine)	$250 - $1000	44017.3					
Inspection of Specially Constructed Vehicles	(Administrative Fine)	$1000 - $5000	44017.4					
Unlicensed Repair Technician/Station	(Administrative Fine)	$1000 - $5000	44032					
Requiring Repairs as a Condition of Testing	(Administrative Fine)	$750 - $3000	44033					
Written Estimate/Repair Notification	(Administrative Fine)	$750 - $3000	44033					
Itemized Charges for Testing and Repair	(Administrative Fine)	$750 - $3000	44033					
Access to Facility/Station	(Administrative Fine)	$1000 - $5000	44035					
Certified EIS Replacement Parts	(Administrative Fine)	$750 - $3000	44036					
Certified Calibration Gases	(Administrative Fine)	$1000 - $5000	44036.5					
Current Address Required	(Administrative Fine)	$250 - $1000					3303.3	

DESCRIPTION	EXPLANATION/SIGNIFICANT DATES (Biennial, Annual, every other year, cyclical, etc.)	CURRENT FEE	H&S CODE	B&P CODE	VEHICLE CODE	CALSTARS	REGULATION	COMMENTS
General Requirements for Smog Check Stations	(Administrative Fine)	$250 - $1000					3340.15	
Test-Only Station Requirements	(Administrative Fine)	$750 - $3000					3340.16	
Repair-Only Station Requirements	(Administrative Fine)	$750 - $3000					3340.16.4	
Test and Repair Station Requirements	(Administrative Fine)	$750 - $3000					3340.16.5	
Test Equipment/ET Transmission Maintenance and Calibration	(Administrative Fine)	$1000 - $5000					3340.17	
Licensed Station that Ceases Operation	(Administrative Fine)	$750 - $3000					3340.23	
Technician Shall Follow Approved Test Procedures	(Administrative Fine)	$1000 - $5000					3340.3	
Technician Shall Report Current Address	(Administrative Fine)	$250 - $1000					3340.3	
Technician Shall Report Employment Change	(Administrative Fine)	$250 - $1000					3340.3	
Certificate of Compliance	(Administrative Fine)	$1000 - $5000					3340.35	
Copy of VIR to Consumer and Attached to Invoice	(Administrative Fine)	$250 - $1000					3340.41	
Use of Improper Access Code/Tampering with EIS	(Administrative Fine)	$750 - $3000					3340.41	
Improper Vehicle Information Entry	(Administrative Fine)	$1000 - $5000					3340.41	
Manufacturer or Industry Standard Inspection and Repair Procedures	(Administrative Fine)	$1000 - $5000					3340.41	
Improper Testing of Directed Vehicle	(Administrative Fine)	$1000 - $5000					3340.41	
Invoice Requirements	(Administrative Fine)	$250 - $1000					3340.41.3	
Test Procedures	(Administrative Fine)	$1000 - $5000					3340.42	
OBD Tests	(Administrative Fine)	$1000 - $5000					3340.42.2	
Tests per Inspection Procedures Manual	(Administrative Fine)	$1000 - $5000					3340.45	
Fleet Facility Work Area	(Administrative Fine)	$750 - $3000					3340.5	
Repair/Certification of Fleet Vehicles Only	(Administrative Fine)	$750 - $3000					3340.5	
Onsite Inspection and Access to Fleet Facility	(Administrative Fine)	$250 - $1000					3340.5	
Fleet Facility Display of Licenses	(Administrative Fine)	$250 - $1000					3340.5	
Written Estimate Requirements	(Administrative Fine)	$250 - $1000					3353	
Forfeited Vehicle					14607.6			Portion of sale revenue
Income from Surplus Money Investment						150300.00		Interest earned from reserve accounts.
Initial Smog Station License	Initial	$100.00	44034				3340.10	
Lamp & Brake Inst/Adj	Initial	$10.00		9887.2				Statute specifies fee amount of $10.00
Lamp & Brake Inst/Adj	Annual Renewal	$5.00		9887.2				Statute specifies fee amount of $5.00
Lamp & Brake Station	Initial	$10.00		9887.2			3306	Statute specifies fee amount of $10.00
Lamp & Brake Station	Annual Renewal	$5.00		9887.2			3306	Statute specifies fee amount of $5.00
Lamp Adjuster	Four year renewal cycle			9887.2			3306 & 3310(d)	

Attachment K

HPRRA Schedule of Workload and Revenue

DESCRIPTION	EXPLANATION/SIGNIFICANT DATES (Biennial, Annual, every other year, cyclical, etc.)	CURRENT FEE	H&S CODE	Regulation	COMMENTS
Smog Abatement Fee	Annual (During first 6 years of a new vehicle)	$4.00	44091.1		Fee is effective for the first 6 years of a new vehicle ($6 to HPRRA during year one and $4 to HPRRA/$2 to VIRF during years 2-6)
Transfer of Funds: VIRF to HPRRA	Transfer of reserve funds from the VIRF to the HPRRA	Misc	44091(d)		Funds that exceed the prudently determined reserve amount for the VIRF shall be available for transfer

Attachment K

EFMS Schedule of Workload and Revenue

DESCRIPTION	EXPLANATION/SIGNIFICANT DATES (Biennial, Annual, every other year, cyclical, etc.)	CURRENT FEE	VEHICLE CODE	Regulation	COMMENTS
Other Motor Vehicle Fees	Annual (part of a consumers annual vehicle registration fee)	$1.00	9250.1		

Attachment L

Bureau of Automotive Repair
Organizational Charts
FY 13-14

Attachment L
CURRENT
FY 2013-14
Total Authorized Positions: 594.8
BL 12-03 (999 Blanket): 22.1

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART

August 2013

DIRECTOR, DCA
DENISE BROWN

CHIEF (VACANT)
646-100-8707-001

Retired Annuitant AQE II
K. Runkle 646-200-9942-907

1.0
CEA I
(Vacant) 646-100-7500-999
Management Services Tech.
S. Lac 646-100-5278-003
Office Technician (Typing)
J. Streepy 646-100-1139-999

1.0
DCA BSO
B. Castro 646-100-5393-808

197.9
DEPUTY CHIEF
PATRICK DORAIS*
SMOG CHECK OPERATIONS, ENGINEERING, RESEARCH, ADMINISTRATION & CONSUMER ASSISTANCE DIVISION
(CEA II)

7.0
Program Support
Staff Services Manager I
SHELLEY WHITAKER

393.9
ASSISTANT CHIEF
DOUGLAS BALATTI
BUREAU OF AUTOMOTIVE REPAIR

392.9
DEPUTY CHIEF
DAN POVEY
FIELD OPERATIONS & ENFORCEMENT DIVISION
(CEA II)

22.0
Technology Services Branch
Data Processing Manager III
DENNIS HAYES

- Network/PC Support — Sr. Info Systems Analyst (Sup) CADY SMITHLINE
- Applications Development — Sr. Program Analyst (Sup) ALAIN KONG

59.5
Engineering & Research Branch
Supervising Air Quality Engineer
LARRY SHERWOOD

- Audits/Roadsides Section — Program Manager II GIL DELUNA
  - Audits/Roadsides — Program Representative III (Sup) MIGUEL VICTORINO
  - Roadsides — Program Representative III (Sup) PAUL THOMAS
- Standards & Training Unit — Sr. Air Quality Engineer ED VANMIL
  - BAR Equipment Certification — Sr. Air Quality Engineer PAUL HEDGLIN
  - Program Evaluation — Sr. Air Quality Engineer GARRETT TORGERSON
  - Technical Support — Sr. Air Quality Engineer JOE PEDROSA

61.9
Consumer Assistance Program
Program Manager II
TIM CORCORAN

- Vehicle Retirement & Quality Control — Program Representative III (Sup) MARK FERNANDEZ
- Repair Assistance & Quality Control — Program Representative III (Sup) RANDY POWERS
- Program Support — Staff Services Manager I TERRI WRIGHT
  - Application Processing — Supervising Program Technician III TERRI LINGGI
  - Phone, Mail & Filing — Supervising Program Technician II VALERIE WALKER

46.5
Licensing Program & Administration Branch
Staff Services Manager II
KAREN OSTTON

- Licensing Program — Staff Services Manager I FRENCHIE MAYUGBA
  - Business Registration/ Licensing & Records Management — Office Services Supervisor III HELENA GILKS
- Personnel — Staff Services Manager I JUDIE BUCCIARELLI
- Business Services and Contracts — Staff Services Manager I CAROL DILLARD

133.4
Northern California Field Operations & Enforcement Branch
Program Manager II
(VACANT)

- Region 1 (Central Valley) — Program Manager I PAT NEELEY
  - Sacramento — Program Representative III (Sup) JAIME RAMOS, CARL HOLMES
  - Fresno — Program Representative III (Sup) GILBERT SANCHEZ, BILL MALONE
  - Bakersfield — Program Representative III (Sup) JOSEPH BLANTON
- Region 2 (San Francisco/ Bay Area) — Program Manager I BOB MACHADO
  - S. San Francisco — Program Representative III (Sup) FIDEL REYES III
  - San Jose — Program Representative III (Sup) DON JOHNSON, LLOYD TANIMASA
  - Hercules — Program Representative III (Sup) JOAQUIN MURPHY

152.9
Southern California Field Operations & Enforcement Branch
Program Manager II
ROD BACA
MATHEW GIBSON (LT)

- Region 4 (Los Angeles) — Program Manager I GEORGE URENA
  - Valencia — Program Representative III (Sup) MARK CASILLAS, JORGE ECHEVARRIA
  - South El Monte — Program Representative III (Sup) ROBERT MARTIN, RICHARD STEELE
  - Culver City — Program Representative III (Sup) DENISE CUNNINGHAM, FELICIANO SANCHEZ
- Region 5 (Orange/Inland Empire/San Diego) — Program Manager I (VACANT)
  - San Diego — Program Representative III (Sup) ANGELA BLUMER, DAVID WINKOWSKI
  - Riverside — Program Representative III (Sup) ARMANDO LOYOLA, LUIS PONCE
  - Irvine — Program Representative III (Sup) MATT LOFTUS, LUKE LONGORIA

37.0
Enforcement Planning & Oversight Branch
Program Manager II
MICHAEL LAFFERTY

- Complaint Review & Case Management — Program Manager I WILLIAM THOMAS
  - Gold Shield Enforcement/ Complaint Review — Program Representative III (Sup) JERRY DINSDALE
  - Complaint Intake — Office Services Supervisor I AUDREY JONES
  - Case Management/ Applications/Citations — Program Representative III (Sup) GREG PEARSON
  - Enforcement Statistics — Staff Services Manager I FRANCES WORDEN
  - Research & Analysis — Staff Services Manager I JEANNE BRODE

68.6
Forensic Documentation Program
Program Manager II
WAYNE RAMOS

- FDP Support & Technical Training — Program Representative III (Sup) JOHN STEINWERT
- Forensic Doc Lab HQ — Program Manager I JON BILOTTA
  - Anaheim — Program Representative III (Sup) AL MOLINA
  - Central Valley (Fresno/Bakersfield) — Program Representative III (Sup) CHRIS KESSLER
  - Fontana — Program Representative III (Sup) WILLIAM ZELENKA
  - Sacramento — Program Representative III (Sup) BRIAN SCHOENBORN
  - San Leandro — Program Representative III (Sup) FIDEL REYES
  - Valencia — Program Representative III (Sup) WAYNE ABRAHAMSON
  - Bakersfield — Program Representative III (Sup) JOEL BILOTTA

*Acting Bureau Chief

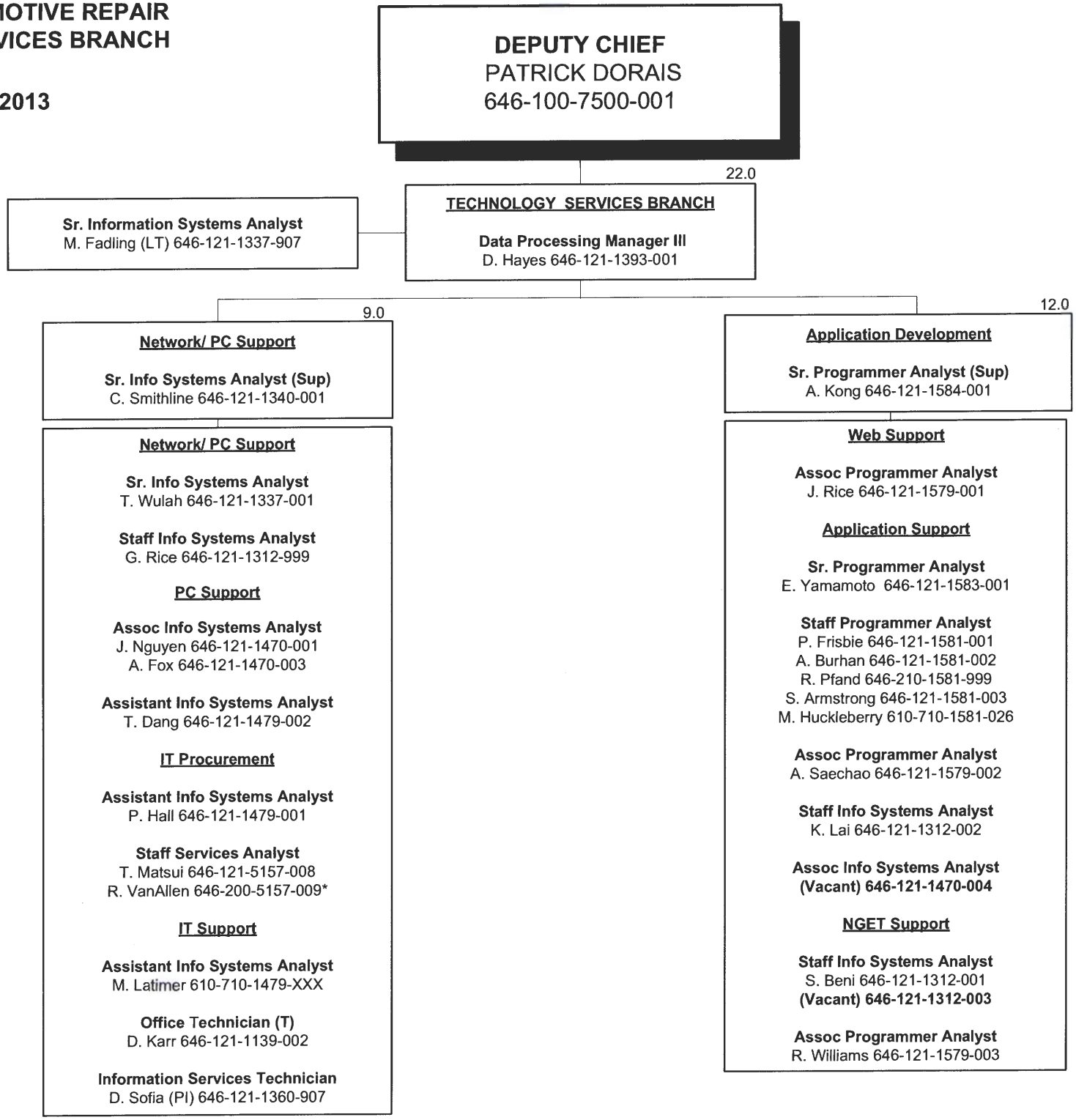
Denise Brown, Director

Patrick Dorais, Acting Bureau Chief

Elaine Onodera, Assistant Personnel Officer/Personnel Analyst

BUREAU OF AUTOMOTIVE REPAIR
TECHNOLOGY SERVICES BRANCH

August 2013



*On loan from CAP

Attachment L

BUREAU OF AUTOMOTIVE REPAIR
ENGINEERING & RESEARCH BRANCH
August 2013

DEPUTY CHIEF
PATRICK DORAIS
646-100-7500-001

7.0
Program Support

Staff Services Manager I
S. Whitaker 646-121-4800-001

Assoc Gov Program Analyst
R. Becker Jr. 646-121-5393-005
V. Somma 646-121-5393-008
K. Marx 646-121-5393-007
(Vacant) 646-121-5393-XXX

Staff Services Analyst
K. Avila-Ellington 646-121-5157-006
Z. Richardson 646-121-5157-007

27.5
AUDITS/ROADSIDES SECTION

Program Manager II
G. Deluna 646-121-6843-001

59.5
ENGINEERING & RESEARCH BRANCH

Supervising Air Quality Engineer
L. Sherwood 646-121-9944-003

13.0
Program Representative III (Sup)
M. Victorino 646-121-6824-001

Audits Unit
Sacramento
Program Representative I
J. Cooper 646-121-6840-007
C. Sells 646-121-6840-010
G. Goodwin 646-121-6840-999

Hercules
Program Representative I
B. Wilson 646-121-6840-011

Riverside
Program Representative I
B. Marshall 646-121-6840-001

South El Monte
Program Representative I
D. Bremer 646-121-6840-009

Paramount
Program Representative I
G. Flores 646-121-6840-012

Valencia
Program Representative I
S. Allen 646-121-6840-013

Roadsides Unit
Sacramento
Program Representative II
G. Prow 646-121-6823-003

Program Representative I
(Vacant) 646-121-6840-999
W. Ahmed 646-121-6840-016
D. Dawson 646-121-6840-017
(Vacant) 646-121-6840-018
D. Loredo 646-121-6840-026
S. Hunter 646-121-6840-999
E. DeBarruel 646-121-6840-999

13.5
Program Representative III (Sup)
P. Thomas 646-121-6824-005

Roadsides Unit
Program Representative II
M. Piercy 646-121-6823-004

Paramount
Program Representative I
M. Tse 646-121-6840-003
G. Magana 646-121-6840-002
F. Hernandez 646-121-6840-014 (.5)
P. Snyder 646-121-6840-025

Jurupa Valley
Program Representative I
U. Carlos 646-121-6840-023 *
D. Dowding 646-121-6840-021
A. Munoz (LT) 646-121-6840-907
T. Kuhns (LT) 646-121-6840-907

Valencia
Program Representative I
(Vacant) 646-121-6840-006
G. Elsayed 646-121-6840-004
J. Opjorden 646-121-6840-020
F. Morgan 646-121-6840-024

South El Monte
Program Representative I
K. Russell 646-121-6840-022

Office Technician (T)
L. Ayala 646-121-1139-001

8.0
Technical Support

Sr. Air Quality Engineer
J. Pedrosa 646-121-9943-001

Air Quality Engineer II
D. Shankute 646-121-9942-007
B. Benjaminson 646-121-9942-013

Air Quality Engineer I
W. Freese 646-121-9941-002
G. Clinciu 646-121-9941-011
C. Upton 646-121-9941-014

Office Technician (T)
P. Cocciante 646-121-1139-003

Office Technician (G)
M. Perona 646-121-1138-001

7.0
Standards & Training Unit

Sr. Air Quality Engineer
E. VanMil 646-121-9943-002

Training & Exam Development

Air Quality Engineer II
G. Garrett 646-121-9942-018

Air Quality Engineer I
C. Jang 646-121-9941-013

Educational Outreach & Planning

Air Quality Engineer II
R. Carlisle 646-121-9942-019

Referee Operations

Air Quality Engineer I
R. Erceg 646-121-9941-018
D. Burnett 646-121-9941-023

Assoc Gov Program Analyst
J. Calindas 646-121-5393-006

8.0
BAR Equipment Certification

Sr. Air Quality Engineer
P. Hedglin 646-121-9943-003

Air Quality Engineer II
T. Lenzie 646-121-9942-002
L. Luther 646-121-9942-004
M. Duewel 646-121-9942-014
G. Sweet 646-121-9942-015

Air Quality Engineer I
P. Chand 646-121-9941-015
C. Emmett 646-121-9941-019
M. Perona 646-121-9941-022

8.0
Program Evaluation

Sr. Air Quality Engineer
G. Torgerson 646-121-9943-004

Air Quality Engineer II
J. Gee 646-121-9942-003
G. Kubik 646-121-9942-005
M. Yang 646-121-9942-006
G. Coburn 646-121-9942-010
R. Gallavan 646-121-9942-012

Air Quality Engineer I
N. Champlin 646-121-9941-001
M. Rubin 646-121-9941-006

* Bilingual

BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

August 2013

DEPUTY CHIEF
Patrick Dorais
646-100-7500-001

Program Manager II
T. Corcoran 646-200-6843-001

Program Support Division — 39.9

Staff Services Manager I
T. Wright 646-200-4800-001

Program Analysis Unit — 2.0

Assoc Gov Program Analyst
N. Sullivan 646-200-5393-012

Staff Services Analyst
J. VanSant 646-200-5157-006
M. Nguyen 646-200-5157-999

Application Processing Unit — 25.4

Supervising Program Tech III
T. Linggi 646-200-9926-003

Application Processing/ Deficiency & Re-Evaluation

Program Technician III
C. Beaslin 646-200-9929-003
C. Hudson 646-200-9929-005

Program Technician II
T. Odabashian 646-200-9928-019
M. Dawicki 646-200-9928-021
(Vacant) 646-200-9928-031
(Vacant) 646-200-9928-033
A. Ram 646-200-9928-034
(Vacant) 646-300-9928-609 (LT)
(Vacant) 646-300-9928-610 (LT)
(Vacant) 646-300-9928-611 (LT)
(Vacant) 646-300-9928-618 (.4) (LT)
(Vacant) 646-300-9928-999 (.6) (LT)

Program Technician
K. Pien 646-200-9927-024
S. Klatt 646-200-9927-025
F. Andrade 646-200-9927-026
K. Henley (LT) 646-300-4687-600 (LT)
C. Hinton 646-300-9927-600 (LT)
R. Lang (LT) 646-300-9927-601 (LT)
T. Riding 646-300-9927-603 (LT)
(Vacant) 646-300-9927-604 (LT)
E. Origel (LT) 646-300-9927-605 (LT)*
D. Garcia (LT) 646-300-9927-606 (LT)
L. Freitas 646-300-9927-607 (LT)

Invoice Processing & Approval

Management Services Technician
R. Parmenter 646-200-5278-008
S. Lathum 646-200-5278-009

Office Technician (T)
(Vacant) 646-200-1139-011

CAP Phone, Mail & Filing Unit — 11.5

Supervising Program Tech II
V. Walker 646-200-9925-999

CAP Phone Information Center & Support Staff

Program Technician II
M. Perez 646-200-9928-003 *
F. Gomez 646-200-9928-008 *
W. Leicht 646-200-9928-011
K. Kauffman 646-200-9928-015
N. Kelly 646-200-9928-032 *

Program Technician
A. Nolan 646-200-9927-017

Mail Process & CAP Support Services

Office Technician (T)
J. Nord (.5) 646-200-1139-012 (.5)
M. Munoz (.5) 646-200-1139-013 (.5)
R. Manglicmot 646-200-1139-015
D. Gutierrez 646-200-1139-016 (.5)
N. Hammonds (PI) 646-200-1139-907
G. Marker (PI) 646-200-1139-907
D. Saechao (PI) 646-200-1139-907
(Vacant) 646-200-1139-999 (.1)
M, Acquisto (PI) 646-200-4687-907

Program Technician II
T. Corsbie 646-200-9928-020

CAP File Management & Retrieval

Office Assistant (T)
B. Briones 646-200-1379-011

Office Assistant (G)
J. Robarts 646-200-1441-007

Technical Services Unit — 61.9

Technical Services Unit — 13.0

Program Representative III (Sup)
R. Powers 646-200-6824-003

Repair Assistance & Quality Control

Program Representative II
N. Strever 646-200-6823-001

Program Representative I
H. Sam 646-200-6840-001
P. Dietler 646-200-6840-003
J. Santos 646-200-6840-006
D. Juarez 646-200-6840-010
F. Hemati 646-200-6840-019
D. Moreau 646-200-6840-038
E. Oback 646-200-6840-039
T. Smith 646-200-6840-041
(Vacant) 646-200-6840-044

Fax Room & Staff Support

Office Technician (T)
D. Partner 646-200-1139-002

Office Technician (G)
C. Beatty 646-200-1138-004

Technical Services Unit — 8.0

Program Representative III (Sup)
M. Fernandez 646-200-6824-002

Vehicle Retirement & Quality Control

Program Representative II
M. Homdus 646-200-6823-002

Program Representative I
L. Kyle 646-200-6840-018
T. Matoba 646-200-6840-021
R. Meyer 646-200-6840-036
H. Pittman 646-200-6840-040

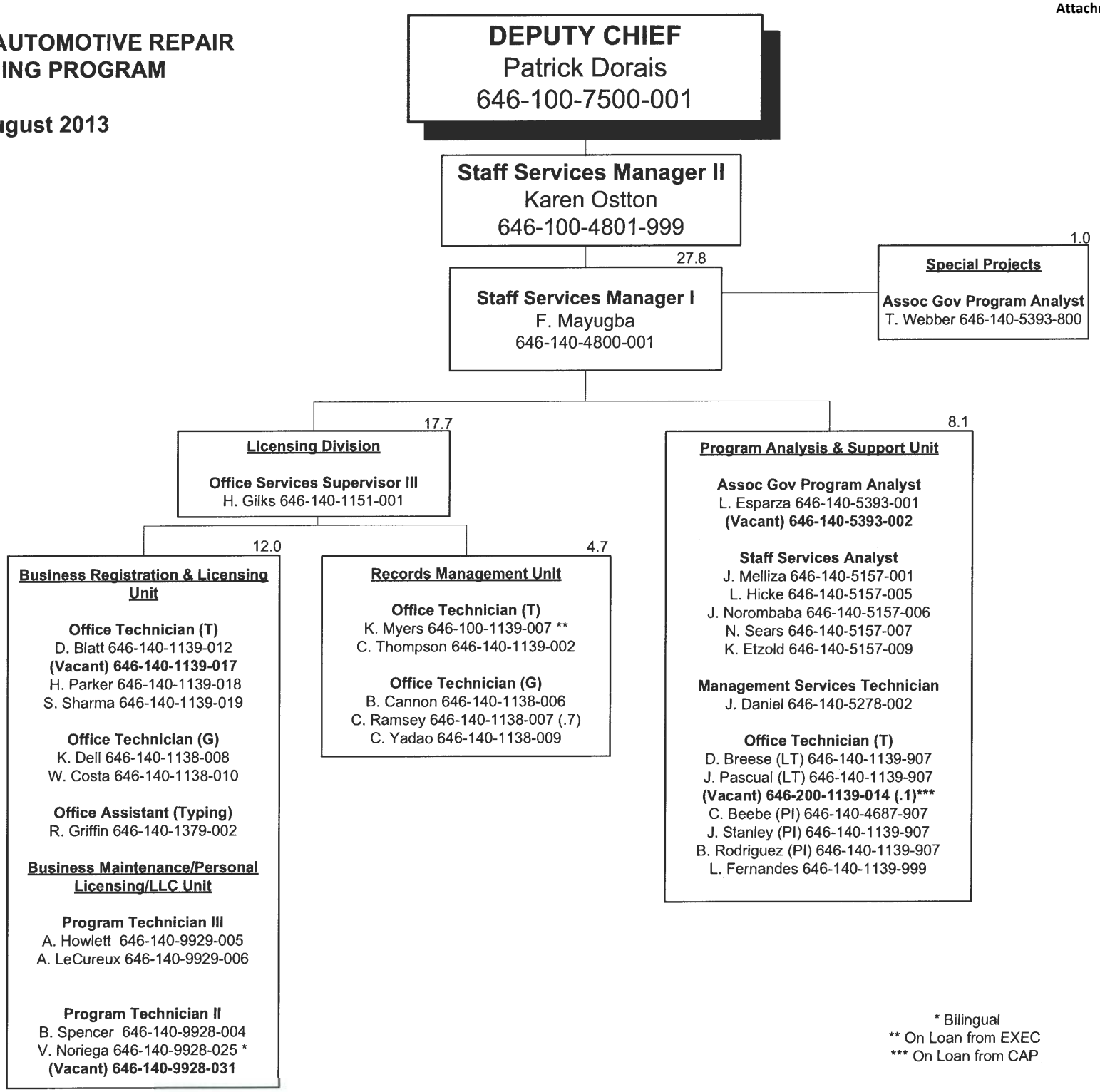
Assoc Gov Program Analyst
E. Cepin 646-200-5393-009

Management Services Technician
D. Kosanovic 646-200-5278-017

* Bilingual

BUREAU OF AUTOMOTIVE REPAIR
LICENSING PROGRAM

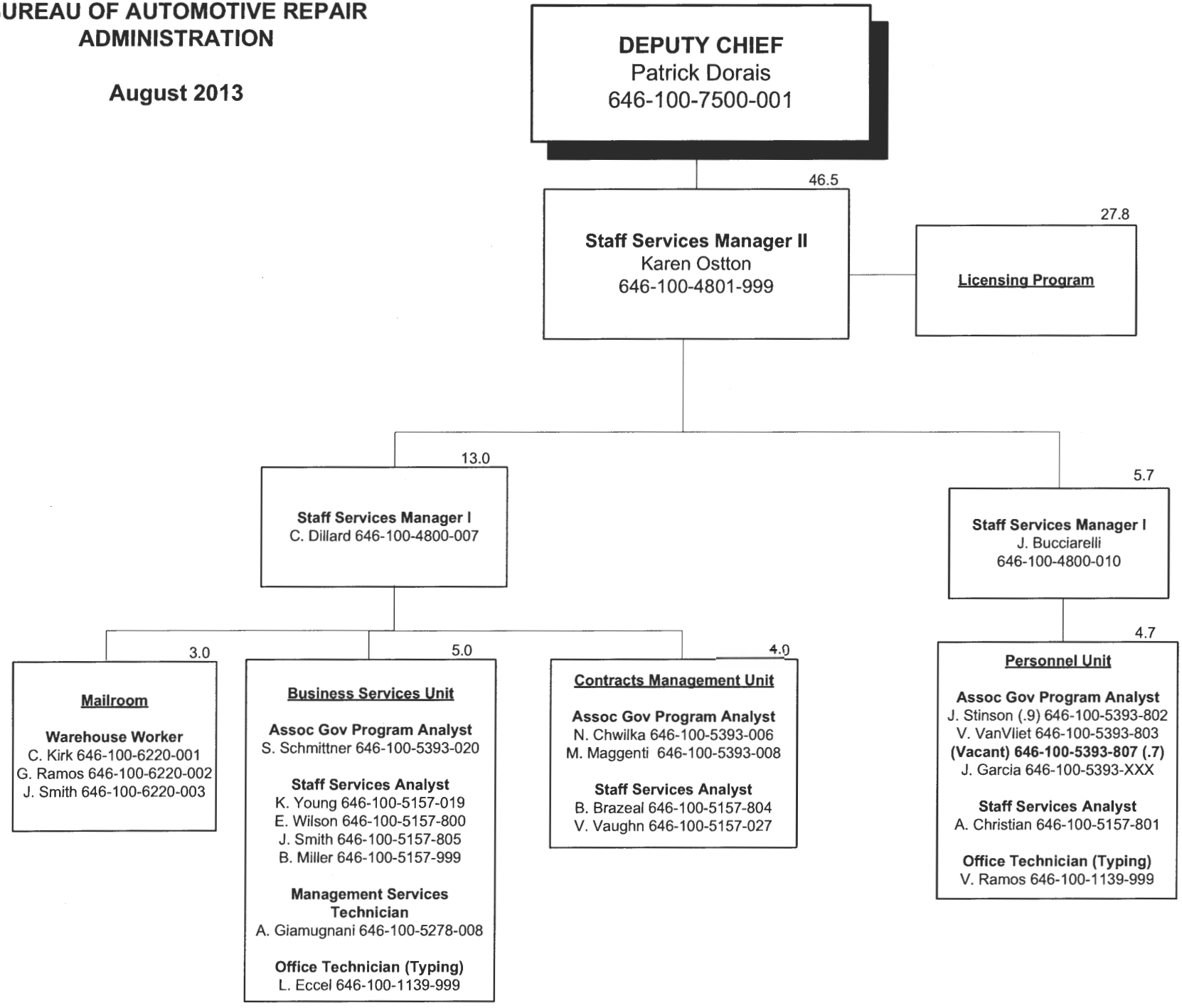
August 2013



* Bilingual
** On Loan from EXEC
*** On Loan from CAP

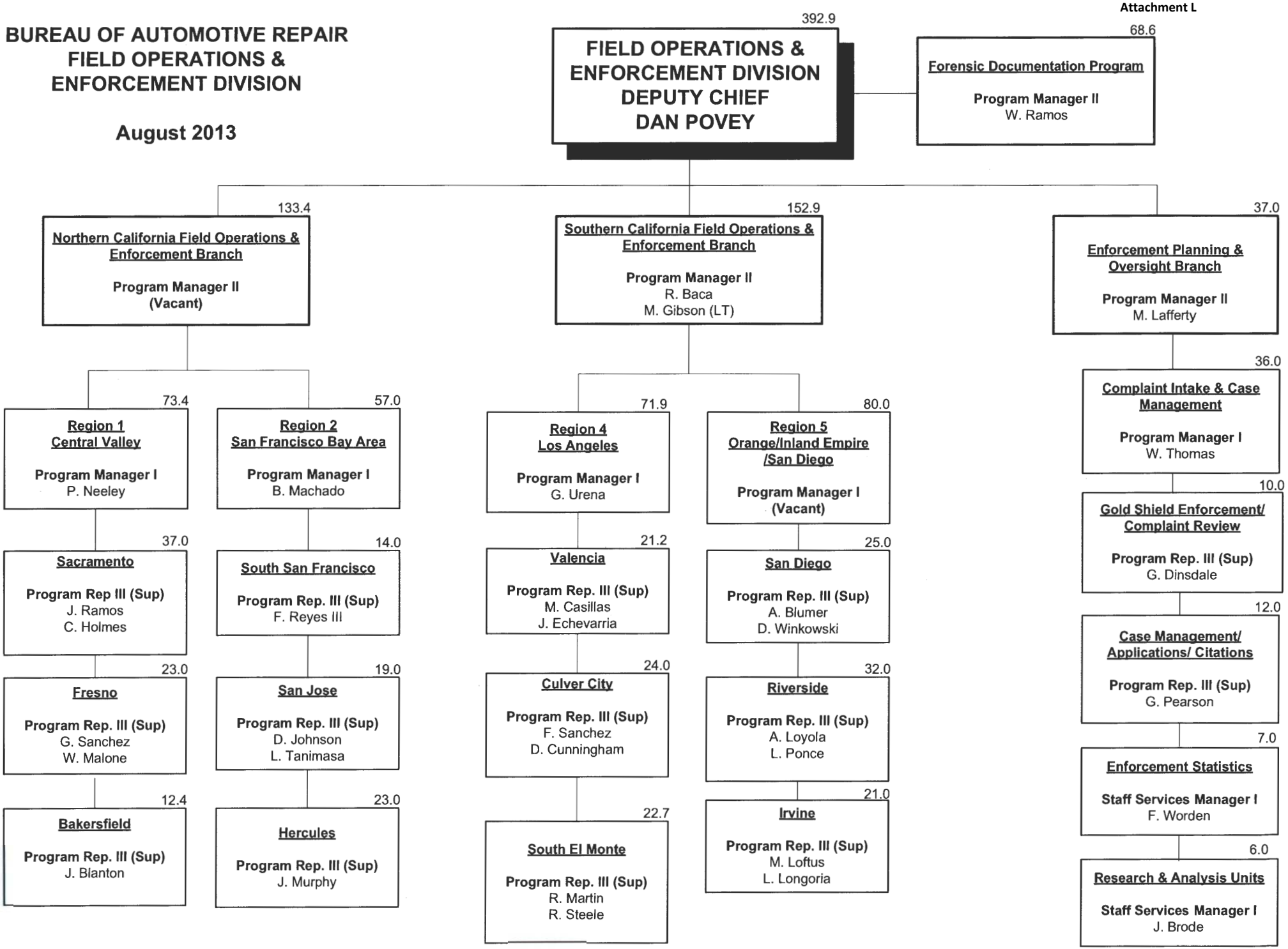
BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

August 2013



BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

August 2013



BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

August 2013

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF DAN POVEY 646-100-7500-005

Northern California Field Operations & Enforcement Branch — 133.4

Program Manager II
D. Povey
646-150-6843-001

Program Representative III (Spec) — 2.0
R. McLarty 646-150-7913-001

Program Representative II
R. Gutierrez 646-150-6823-008

Region I Central Valley — 73.4

Program Manager I
P. Neeley
646-150-6842-004

Sacramento — 37.0

Program Representative III (Sup)
J. Ramos 646-152-6824-002 *
C. Holmes 646-152-6824-003

Program Representative II
M. Guess 646-152-6823-002
T. Bowden 646-152-6823-003
M. Johnson 646-152-6823-005
M. Eddy 646-152-6823-008
J. Hammer 646-152-6823-009
M. Sacco 646-152-6823-999

Program Representative I
D. Mueller 646-152-6840-002
K. Renihan 646-152-6840-003
B. Cole 646-152-6840-004
P. Lessard 646-152-6840-005
D. Brown 646-152-6840-008
T. O'Neill 646-152-6840-009
T. Wilson 646-152-6840-011
T. Toy 646-152-6840-012
C. Woodward 646-152-6840-013
J. Rodriguez 646-152-6840-014
E. Schulte 646-152-6840-016
K. Myers 646-152-6840-017
T. Schaumburg 646-152-6840-018
(Vacant) 646-152-6840-020
T. White 646-152-6840-021
J. Dickerman 646-152-6840-022
R. Schumann 646-152-6840-024
P. McReynolds 646-152-6840-025
B. Lee 646-152-6840-027
K. Tetlow 646-152-6840-028
M. Lara 646-152-6840-029
P. Zellmer 646-152-6840-030
B. Hancock 646-152-6840-031
M. Barnett 646-152-6840-032
(Vacant) 646-152-6840-033
S. Treadway 646-210-6840-031
A. Marquez 646-152-6840-034

Office Technician (T)
J. Wright 646-152-1139-004
R. Thomas 646-152-1139-011

Office Assistant (T)
K. Sanchez 646-152-1379-001

Fresno — 23.0

Program Representative III (Sup)
G. Sanchez 646-154-6824-001
W. Malone 646-154-6824-002

Program Representative II
W. Nicks 646-154-6823-002
J. Esmay 646-154-6823-003
W. Thygesen 646-154-6823-005
A. Lee 646-154-6823-006

Program Representative I
J. Gonzalez 646-154-6840-001 *
J. Tikijian 646-154-6840-003
J. Moore 646-154-6840-006
J. Lewis 646-154-6840-008
D. Bryant 646-154-6840-009
B. Young 646-154-6840-010
J. Lee 646-154-6840-011
M. Morse 646-154-6840-012
J. Enos 646-154-6840-014
E. Lopez 646-154-6840-015
G. Gean 646-154-6840-017
R. Grasmick 646-154-6840-018
J. Mondeau 646-154-6840-019 *
E. Nichols 646-154-6840-020
G. Castro 646-154-6840-021 *

Office Technician (T)
R. Martinez 646-154-1139-002 *
M. Correa 646-154-1139-006 *

Bakersfield — 12.4

Program Representative III (Sup)
J. Blanton 646-155-6824-002

Program Representative II
J. Smith 646-155-6823-001
E. Lopez 646-155-6823-002 *
P. Narayan 646-155-6823-006

Program Representative I
K. Teraoka 646-155-6840-002
R. Coble 646-155-6840-003
A. Copeland 646-155-6840-005
C. McClenny 646-155-6840-007
J. Salas 646-155-6840-010 *
D. Moyer 646-155-6840-012

Office Technician (T)
S. Speer 646-155-1139-001 *
C. Bradley 646-155-1139-003
A. Palmer 646-155-1139-004 (.4)

Region 2 San Francisco Bay Area — 57.0

Program Manager I
B. Machado
646-150-6842-003

South San Francisco — 14.0

Program Representative III (Sup)
F. Reyes III 646-162-6824-001

Program Representative II
B. Saugez 646-162-6823-001
W. Sam 646-162-6823-002

Program Representative I
A. Moreno 646-162-6840-003
N. Cano 646-162-6840-004
G. Sato 646-162-6840-005
H. Jennings 646-162-6840-006
C. Cummings 646-162-6840-007
P. Kuffel 646-162-6840-008
M. Rivas 646-162-6840-009
D. Cervantez 646-162-6840-010
J. Ribiero 646-162-6840-012

Office Technician (T)
Y. Lindsey 646-162-1139-001
(Vacant) 646-162-1139-002 *
V. Buell (LT) 646-162-1139-907

San Jose — 19.0

Program Representative III (Sup)
D. Johnson 646-153-6824-001
L. Tanimasa 646-153-6824-002

Program Representative II
L. West 646-153-6823-001
K. Windsor 646-153-6823-002
F. Fortugaliza 646-153-6823-005

Program Representative I
M. Sexton 646-153-6840-001
A. Escobar 646-153-6840-003
S. Savage 646-153-6840-005
W. Gress 646-153-6840-008
D. Hernandez 646-153-6840-009
K. Smith 646-153-6840-010
J. Sunseri 646-153-6840-011
A. Avdeef 646-153-6840-012
J. Anderson 646-153-6840-019
A. Sanchez 646-153-6840-020
S. Orozco 646-153-6840-021 *

Office Technician (T)
H. Umali 646-153-1139-001
F. Jaculina 646-153-1139-003

Office Assistant (T)
P. Vera 646-153-1379-001

Hercules — 23.0

Program Representative III (Sup)
J. Murphy 646-151-6824-002

Program Representative II
M. Rodriguez 646-151-6823-002
G. Huffer 646-151-6823-004
J. Mora 646-151-6823-007 *
D. Breitbach 646-151-6823-008
S. Rhodes 646-151-6823-009

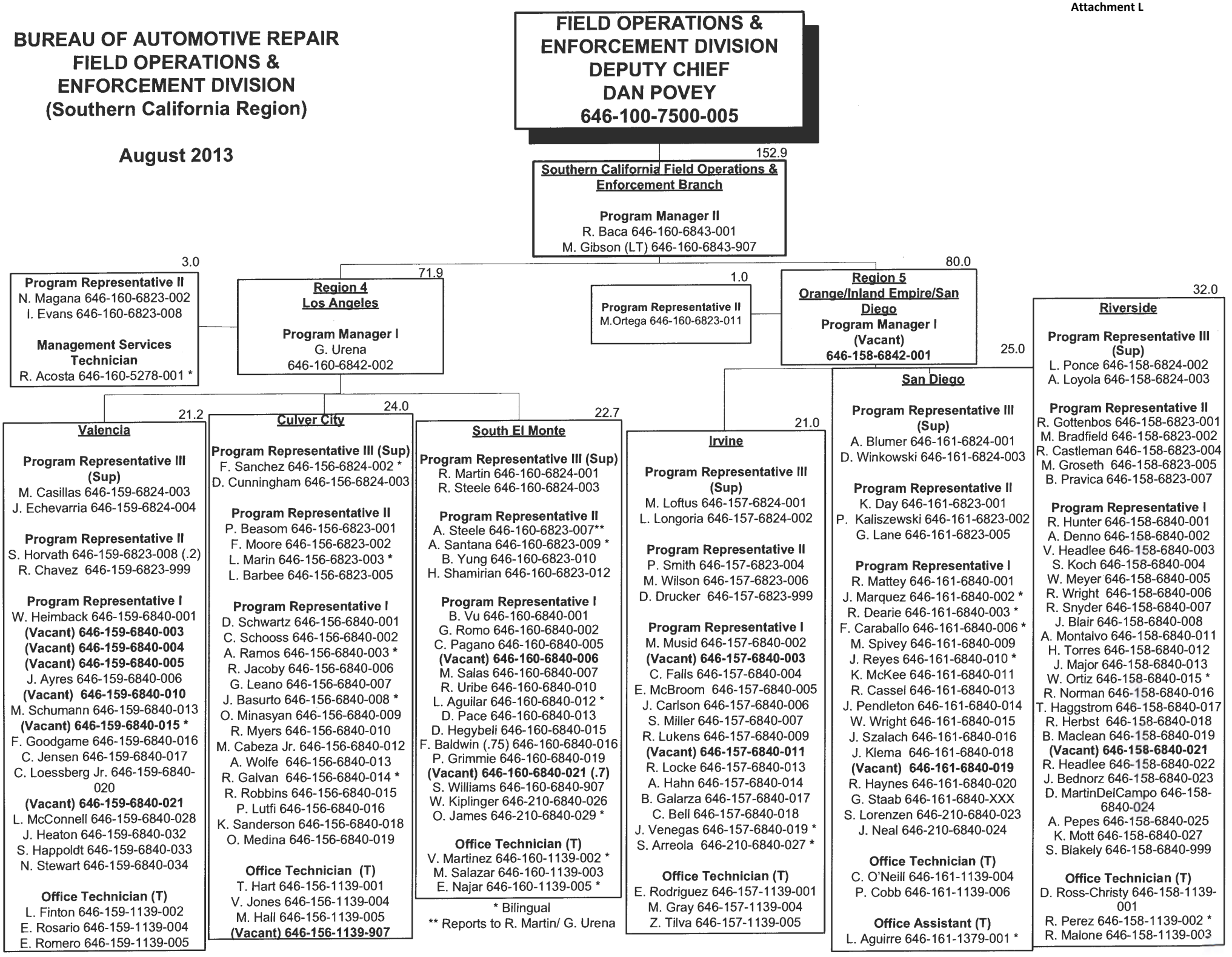
Program Representative I
G. Sneller 646-151-6840-002
M. Loveless 646-151-6840-003
S. Choy 646-151-6840-005
G. Wilson 646-151-6840-006
B. Withnell 646-151-6840-007
P. Rice 646-151-6840-008
F. Chu 646-151-6840-014
R. Ortiz 646-151-6840-015
C. Lev 646-151-6840-017
G. Bernes 646-151-6840-018
R. Peach 646-151-6840-019
Z. Ali 646-151-6840-021
R. Perkins 646-151-6840-022
M. Avitia 646-151-6840-024 *
R. Leggett 646-151-6840-031

Office Technician (T)
L. Witt-Saucer 646-151-1139-002
E. Simmons 646-151-1139-004

* Bilingual

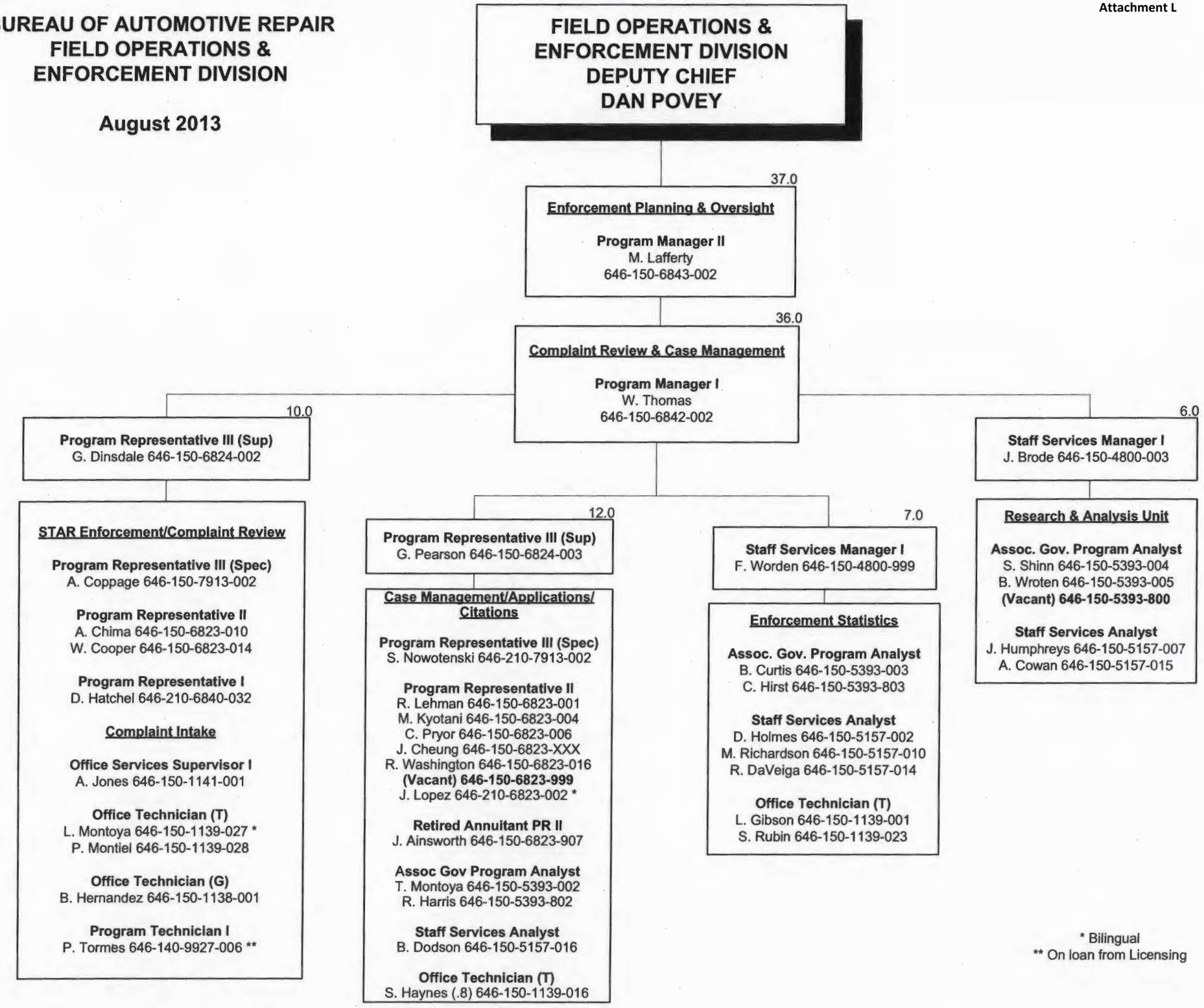
BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

August 2013



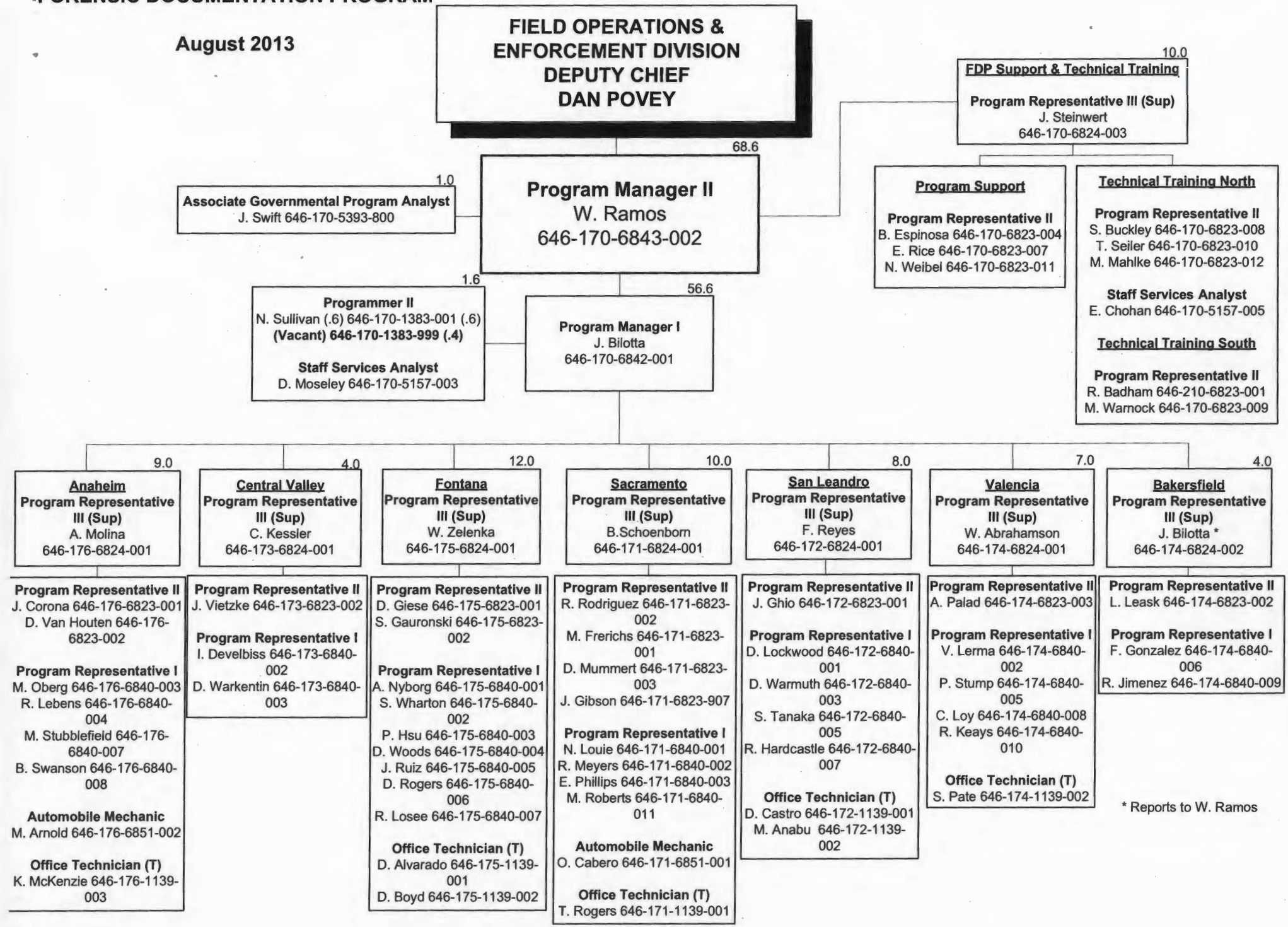
BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

August 2013



BUREAU OF AUTOMOTIVE REPAIR
FORENSIC DOCUMENTATION PROGRAM

August 2013



Attachment M

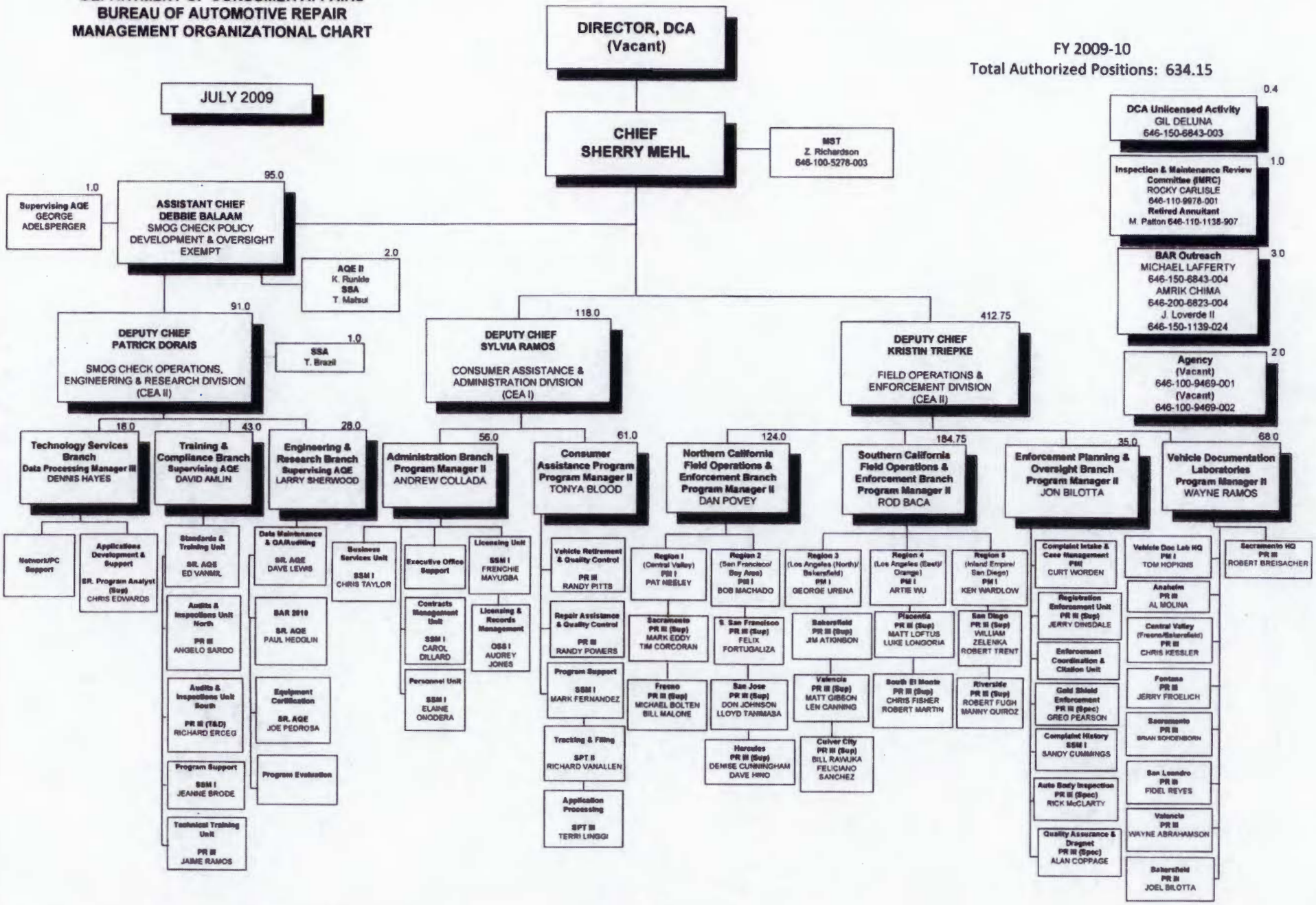
Bureau of Automotive Repair
Organizational Charts
FY 09-10 through FY 12-13

Attachment M

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART

JULY 2009

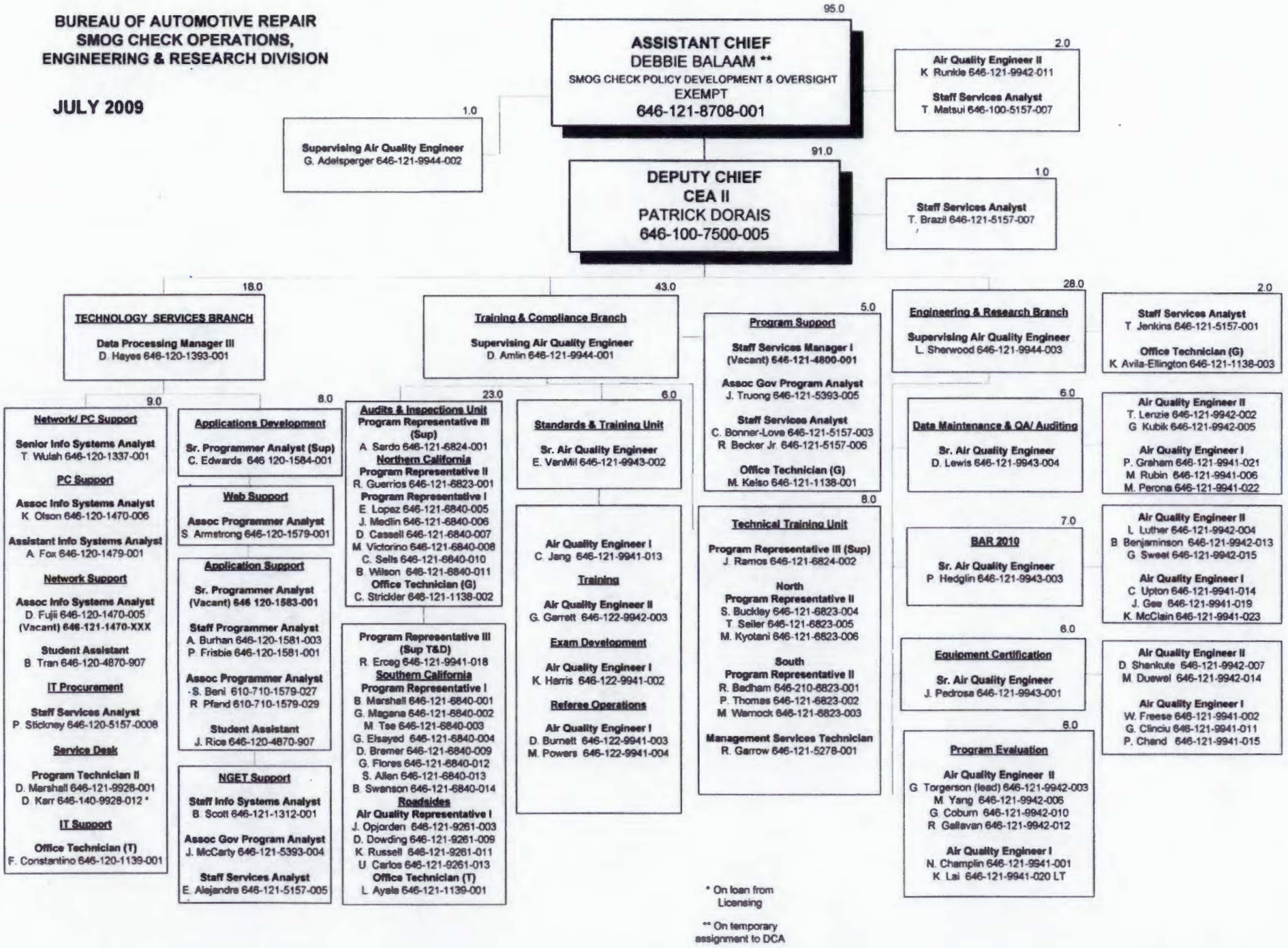
FY 2009-10
Total Authorized Positions: 634.15



Attachment M

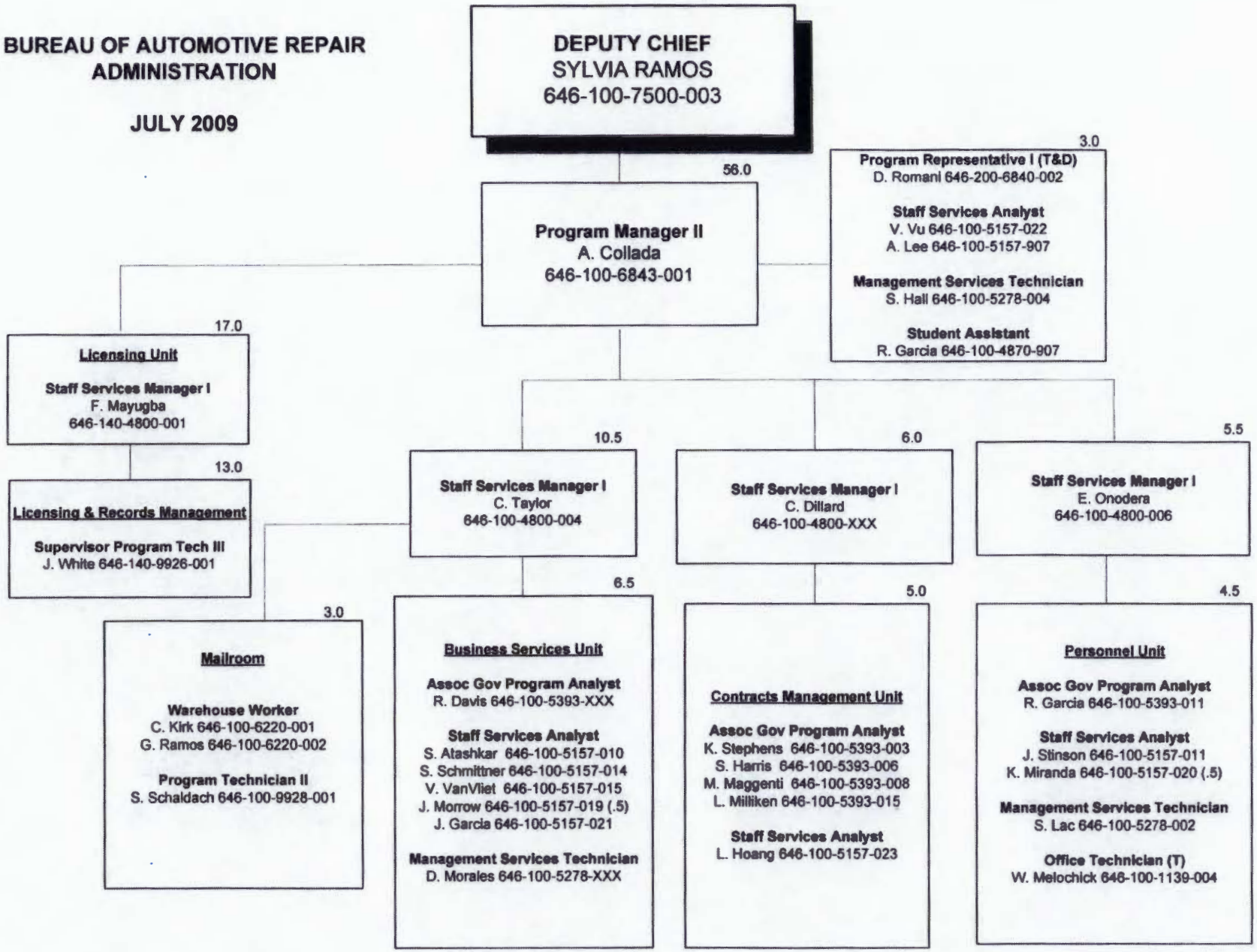
BUREAU OF AUTOMOTIVE REPAIR
SMOG CHECK OPERATIONS, ENGINEERING & RESEARCH DIVISION

JULY 2009



BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

JULY 2009



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

JULY 2009

DEPUTY CHIEF
SYLVIA RAMOS
646-100-7500-003

1.0
Assoc Gov Program Analyst
D. McKernon 646-200-5393-003

61.0
Program Manager II
T. Blood
646-200-6843-001

32.0
Program Support

Staff Services Manager I
(Vacant)
646-200-4800-001

3.0
Program Analysis

Staff Services Analyst
N. Sullivan 646-200-5157-003
V. Manning 646-200-5157-006
V. Somma 646-200-5157-009

17.0
Application Processing

Supervising Program Tech III
T. Linggi 646-200-9926-003

Application Processing, Deficiency & Re-evaluation Unit

Program Technician III
R. Basped 646-200-9929-003
E. Silva 646-200-9929-004 *
B. Poole 646-200-9929-005
Program Technician II
T. Odabashian 646-200-9928-003
S. Lloyd 646-200-9928-004
D. Kosanovic 646-200-9928-007
C. Beaslin 646-200-9928-011
M. Dennis 646-200-9928-017
S. Rankin 646-200-9928-018
Program Technician
C. Hudson 646-200-9927-003
B. Spencer 646-200-9927-021
M. Nguyen 646-200-9927-025
Student Assistant
L. Thomason 646-200-4870-907
C. Seawell 646-200-4870-907
G. Martucci 646-200-4870-907
A. Christian 646-200-4870-907

Invoice Processing & Approval Unit

Management Services Technician
M. Epstein 646-200-5278-004
R. Parmenter 646-200-5278-008
S. Lathum 646-200-5278-009

Office Technician (T)
H. Merrifield 646-200-1139-005

11.0
Tracking & Filing

Supervising Program Tech II
R. VanAllen 646-200-9925-002

CAP Phone Information Center & Support Staff Unit

Program Technician II
A. Harmon 646-200-9928-008
C. Gomez 646-200-9928-012
T. Corsbie 646-200-9928-015

Retired Annuitant Program Tech II
J. Ortiz 646-200-9928-907
D. Coleman 646-200-9928-907

Program Technician
A. Nolan 646-200-9927-017
N. Kelly 646-200-9927-022 *
J. Munoz 646-200-9927-023 *

Student Assistant
A. Martucci 646-200-4870-907 **

CAP File Management & Retrieval Unit
Office Assistant (T)
B. Briones 646-200-1379-011
Office Assistant (G)
J. Roberts 646-200-1441-007

Mail Process & CAP Support Services
Program Technician I
N. Almendarez 646-200-9927-024
Office Technician (Typing)
C. Osorio 646-200-1139-009

19.0
Technical Services

Program Representative III (Sup)
R. Powers 646-200-6824-003

18.0
Repair Assistance & Quality Control Unit

Program Representative II
N. Strever 646-200-6823-001

Program Representative I
H. Sam 646-200-6840-001
P. Dietler 646-200-6840-003
R. Powers 646-200-6840-006
D. Juarez 646-200-6840-010
F. Hemati 646-200-6840-019
P. Lessard 646-200-6840-033
D. Moreau 646-200-6840-038
E. Oback 646-200-6840-039
T. Smith 646-200-6840-041
J. Santos 646-200-6840-044
J. Horton 646-200-6840-045

Fax Room Unit/Support

Office Technician (T)
D. Partner 646-200-1139-002
(Vacant) 646-200-1139-XXX**

Office Technician (G)
M. Leyva 646-200-1138-002
J. Van Sant 646-200-1138-003

Program Technician
P. Lujan 646-200-9927-026

Office Assistant (G)
T. Gwarada 646-200-1441-012

8.0
Technical Services

Program Representative III (Sup)
R. Pitts
646-200-6824-002

7.0
Vehicle Retirement & Quality Control Unit

Program Representative III (Sup)
R. Pitts 646-200-6824-907

Program Representative II
M. Homdus 646-200-6823-002

Program Representative I
L. Kyle 646-200-6840-018
T. Matoba 646-200-6840-021
R. Meyer 646-200-6840-036
H. Pittman 646-200-6840-040

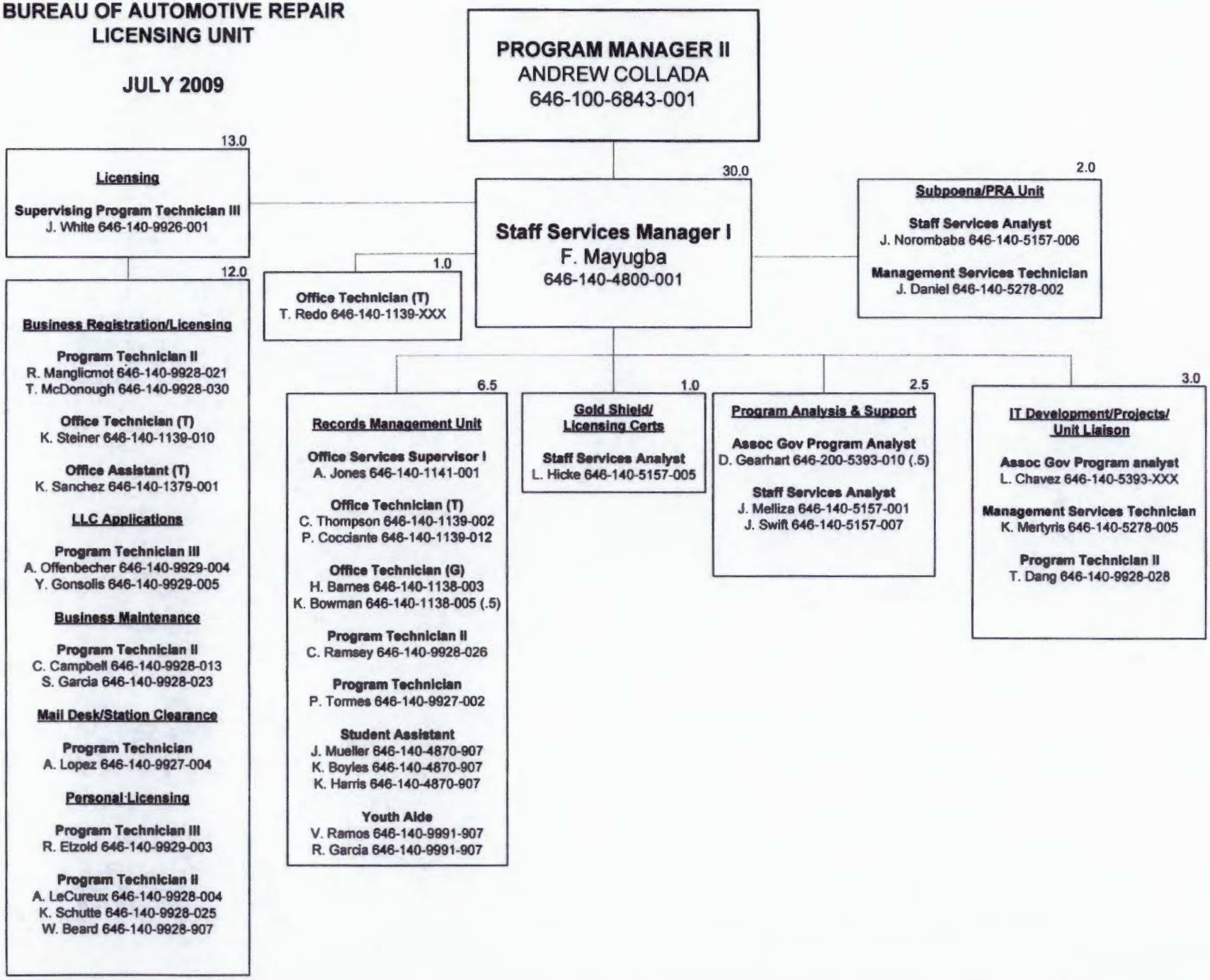
Assoc Gov Program Analyst
E. Cepin 646-200-5393-009

Management Services Technician
C. Seeley 646-200-5278-017

* Bilingual
** On loan to Licensing

BUREAU OF AUTOMOTIVE REPAIR
LICENSING UNIT

JULY 2009



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

JULY 2009

412.75
FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
KRISTIN TRIEPKE

68.0
Vehicle Documentation Program
Program Manager II
W. Ramos

124.0
Northern California Field Operations & Enforcement Branch
Program Manager II
D. Povey

184.75
Southern California Field Operations & Enforcement Branch
Program Manager II
R. Baca

35.0
Enforcement Planning & Oversight Branch
Program Manager II
J. Bilotta

60.0
Region 1 Central Valley
Program Manager I
P. Neeley

34.0
Sacramento
Program Rep III (Sup)
M. Eddy
T. Corcoran

24.0
Fresno
Program Rep. III (Sup)
M. Bolten
W. Malone

63.0
Region 2 San Francisco Bay Area
Program Manager I
B. Machado

11.0
South San Francisco
Program Rep. III (Sup)
F. Fortugaliza

24.0
San Jose
Program Rep. III (Sup)
D. Johnson
L. Tanimasa

26.0
Hercules
Program Rep. III (Sup)
D. Cunningham
D. Hino

68.0
Region 3 Los Angeles (North) / Bakersfield
Program Manager I
G. Urena

16.0
Bakersfield
Program Rep. III (Sup)
J. Atkinson

25.0
Valencia
Program Rep. III (Sup)
M. Gibson
L. Canning

25.0
Culver City
Program Rep. III (Sup)
B. Rawuka
F. Sanchez

51.75
Region 4 Los Angeles (East) / Orange
Program Manager I
A. Wu

24.0
Placentia
Program Rep. III (Sup)
M. Loftus
L. Longoria

24.75
South El Monte
Program Rep. III (Sup)
C. Fisher
R. Martin

64.0
Region 5 Inland Empire / San Diego
Program Manager I
K. Wardlow

28.0
San Diego
Program Rep. III (Sup)
W. Zelenka
R. Trent

34.0
Riverside
Program Rep. III (Sup)
R. Fugh
M. Quiroz

3.0
Registration Enforcement Unit
Program Rep. III (Sup)
G. Dinsdale

3.0
Gold Shield Enforcement
Program Rep. III (Spec)
G. Pearson

6.0
Complaint Intake & Case Management
Program Manager I
C. Worden

10.0
Enforcement Coordination & Citation Unit

8.0
Complaint /History
Staff Services Manager I
S. Cummings

1.0
Auto Body Inspection
Program Rep. III (Spec)
R. McClarty

1.0
Quality Assurance & Dragnet
Program Rep. III (Spec)
A. Coppage

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

JULY 2009

FIELD OPERATIONS & ENFORCEMENT DIVISION
DEPUTY CHIEF
KRISTIN TRIEPKE
646-100-7500-005

124.0

Northern California Field Operations & Enforcement Branch

Program Manager II
D. Povey
646-150-6843-001

1.0

Program Representative II
R. Gutierrez
646-150-6823-008

1.0

Program Representative II
J. Ainsworth
646-150-6823-006

34.0

Sacramento

Program Representative III (Sup)
(Vacant) 646-152-6824-002
T. Corcoran 646-152-6824-003

Program Representative II
C. Holmes 646-152-6823-002
T. Bowden 646-152-6823-003
M. Johnson 646-152-6823-005
M. Eddy 646-152-6823-008
J. Dingman 646-152-6823-009

Program Representative I
D. Mueller 646-152-6840-002
K. Renihan 646-152-6840-003
B. Cole 646-152-6840-004
K. Kubach 646-152-6840-005
K. Besson 646-152-6840-007
D. Brown 646-152-6840-008
T. O'Neill 646-152-6840-009
T. Wilson 646-152-6840-011
T. Toy 646-152-6840-012
C. Woodward 646-152-6840-013
J. Rodgiguez 646-152-6840-014
(Vacant) 646-152-6840-016
K. Myers 646-152-6840-017
T. Schaumburg 646-152-6840-018
P. McReynolds 646-152-6840-019
W. Boese 646-152-6840-020
T. White 646-152-6840-021
M. Guess 646-152-6840-022
R. Schumann 646-152-6840-024
J. Dickerman 646-152-6840-026
J. Sunseri 646-152-6840-027
J. Wilcox 646-152-6840-028
G. Michelier 646-152-6840-029
C. Pryor 646-210-6840-031
A. Flores 646-152-6840-907

Office Technician (T)
J. Wright 646-152-1139-004
H. Parker 646-152-1139-010

OfficeTechnician (G)
L. Gouge 646-152-1138-001

60.0

Region I
Central Valley

Program Manager I
P. Neeley
646-150-6842-004

24.0

Fresno

Program Representative III (Sup)
M. Bolten 646-154-6824-001
W. Malone 646-154-6824-002

Program Representative II
G. Sanchez 646-154-6823-002
J. Esmay 646-154-6823-003
L. Sweger 646-154-6823-005
A. Lee 646-154-6823-006

Program Representative I
D. Kiehn 646-154-6840-001
J. Tikijian 646-154-6840-003
J. Wigginton 646-154-6840-006
J. Lewis 646-154-6840-008
W. Thygesen 646-154-6840-009
B. Young 646-154-6840-010
W. Nicks 646-154-6840-011
M. Morse 646-154-6840-012
J. Enos 646-154-6840-014
W. Bennett 646-154-6840-015
G. Gean 646-154-6840-017
R. Grasmick 646-154-6840-018
J. Mondeau 646-154-6840-019 *
E. Nichols 646-154-6840-020
G. Castro 646-154-6840-021

Office Technician (T)
R. Martinez 646-154-1139-002 *
A. Mora 646-154-1139-005 *

Office Assistant (T)
A. Mendez 646-154-1379-001 *

63.0

Region 2
San Francisco Bay Area

Program Manager I
B. Machado
646-150-6842-003

11.0

South San Francisco

Program Representative III (Sup)
F. Fortugaliza 646-162-6824-001

Program Representative II
B. Saugez 646-162-6823-001

Program Representative I
R. Leggett 646-162-6840-002
A. Moreno 646-162-6840-003 *
D. Fuller 646-162-6840-004
B. Heimback 646-162-6840-005
H. Jennings 646-162-6840-006
J. Pendleton 646-162-6840-007
P. Kuffel 646-162-6840-008

Office Technician (T)
Y. Lindsey 646-162-1139-001
B. Raygoza 646-162-1139-002
J. Broaster 646-162-1139-907

24.0

San Jose

Program Representative III (Sup)
D. Johnson 646-153-6824-001
L. Tanimasa 646-153-6824-002

Program Representative II
L. West 646-153-6823-001
K. Windsor 646-153-6823-002
W. Wilson 646-153-6823-004
W. Sam 646-153-6823-005

Program Representative I
M. Sexton 646-153-6840-001
A. Escobar 646-153-6840-003
D. Cervantez 646-153-6840-004
P. Tierney 646-153-6840-005
W. Gress 646-153-6840-008
D. Hernandez 646-153-6840-009
N. Petrushkin 646-153-6840-010
W. Long 646-153-6840-011
A. Avdeef 646-153-6840-012
F. Ling 646-153-6840-013 *
M. Rivas 646-153-6840-014
J. Anderson 646-153-6840-019
A. Sanchez 646-153-6840-020
W. Thomas 646-153-6840-021
J. Houk 646-153-6840-023

Office Technician (T)
H. Umali 646-153-1139-001
F. Jaculina 646-153-1139-003

Office Assistant (T)
P. Vera 646-153-1379-001

26.0

Hercules

Program Representative III (Sup)
D. Hino 646-151-6824-001
D. Cunningham 646-151-6824-002

Program Representative II
M. Rodriguez 646-151-6823-002
G. Huffer 646-151-6823-004
J. Mora 646-151-6823-007 *
J. Cheung 646-151-6823-008

Program Representative I
G. Sneller 646-151-6840-002
M. Loveless 646-151-6840-003
G. Bernes 646-151-6840-005
G. Wilson 646-151-6840-006
B. Withnell 646-151-6840-007
P. Rice 646-151-6840-008
F. Chu 646-151-6840-014
R. Ortiz 646-151-6840-015
C. Lev 646-151-6840-017
S. Orozco 646-151-6840-018
R. Peach 646-151-6840-019
D. Breitbach 646-151-6840-020
Z. Ali 646-151-6840-021
R. Perkins 646-151-6840-022
D. Loredo 646-151-6840-023
M. Avitia 646-151-6840-024
S. Rhodes 646-151-6840-025

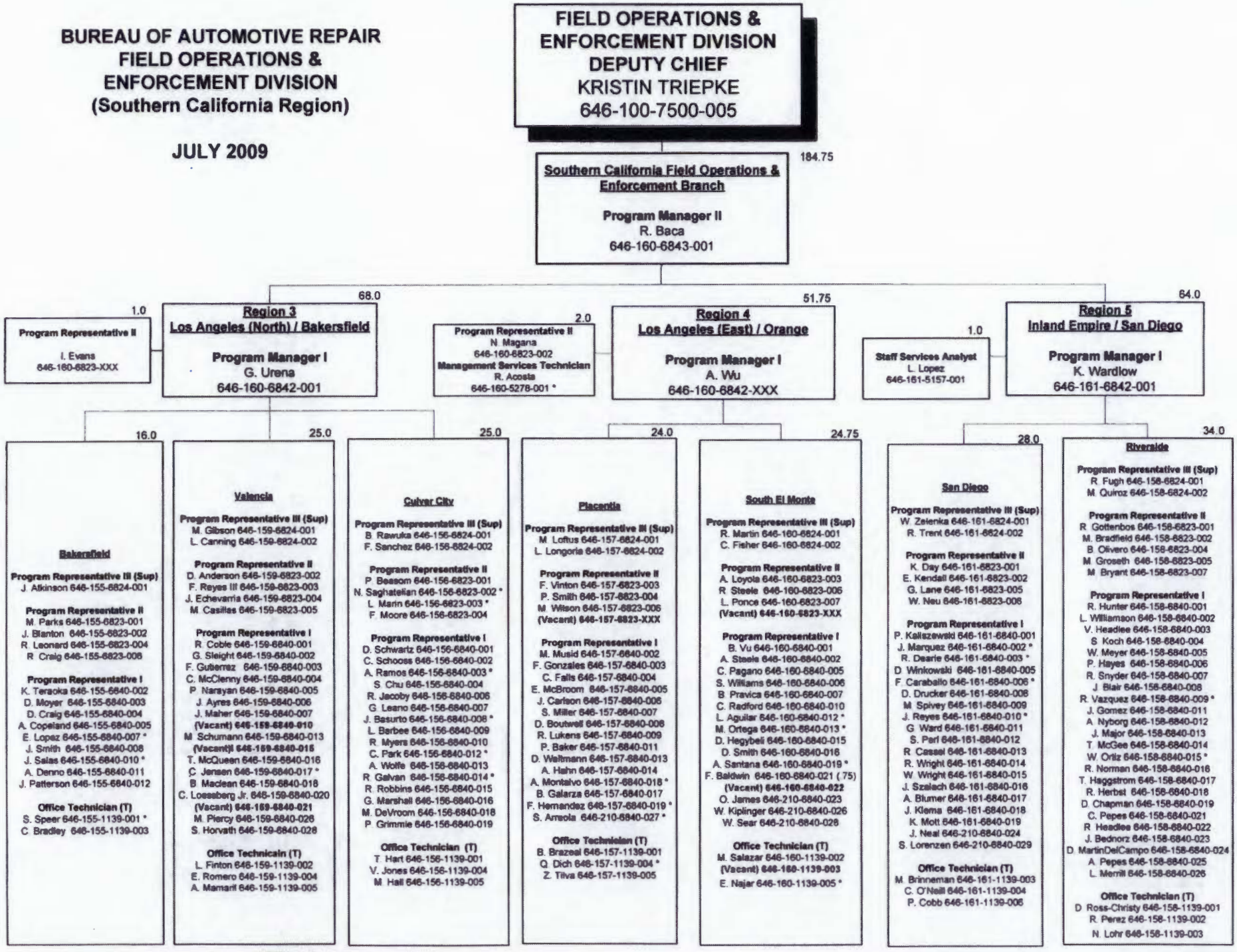
Office Technician (T)
L. Witt-Saucer 646-151-1139-002
E. Simmons 646-151-1139-004
(Vacant) 646-151-1139-005

* Bilingual

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

JULY 2009

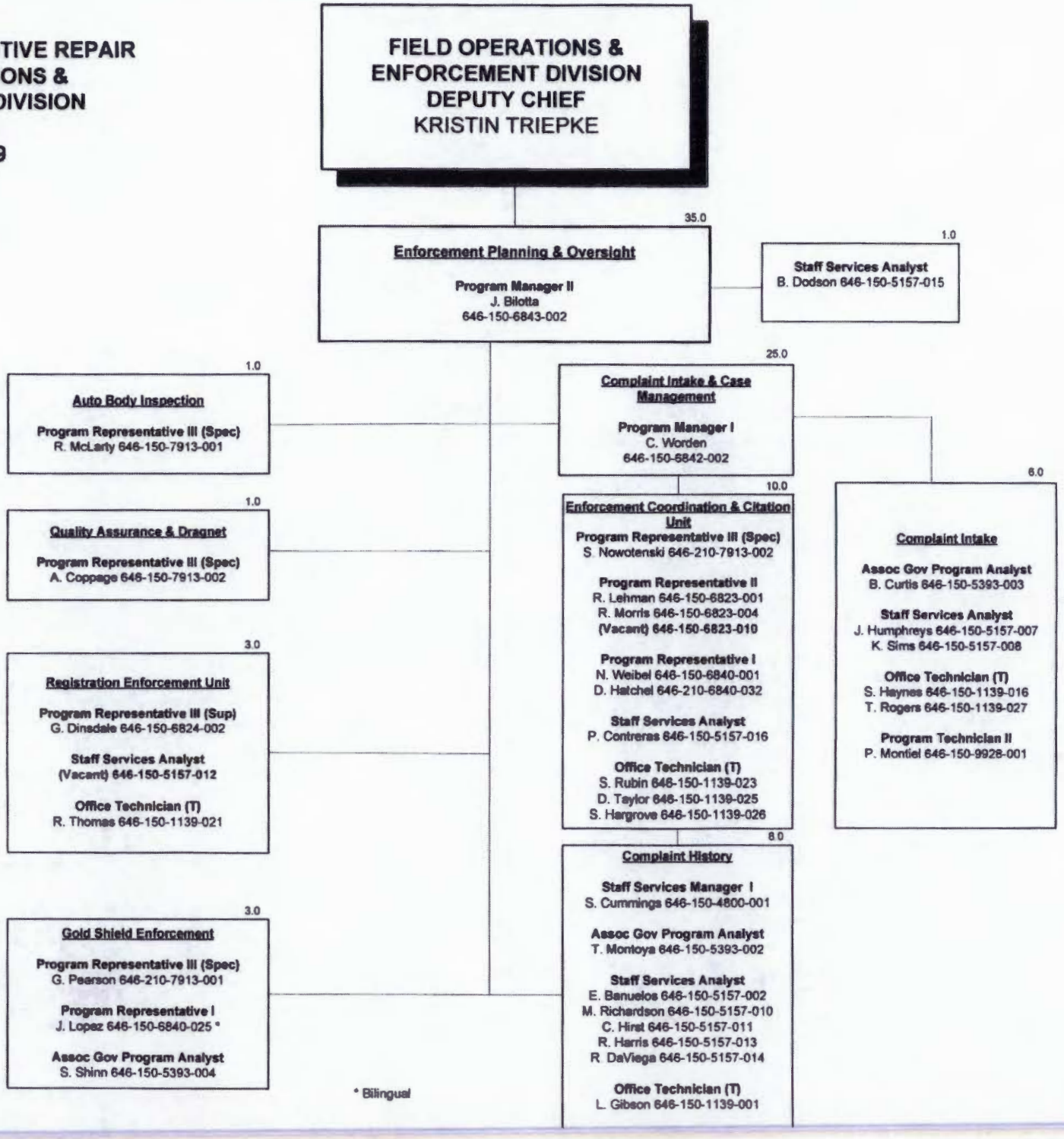


* Bilingual

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

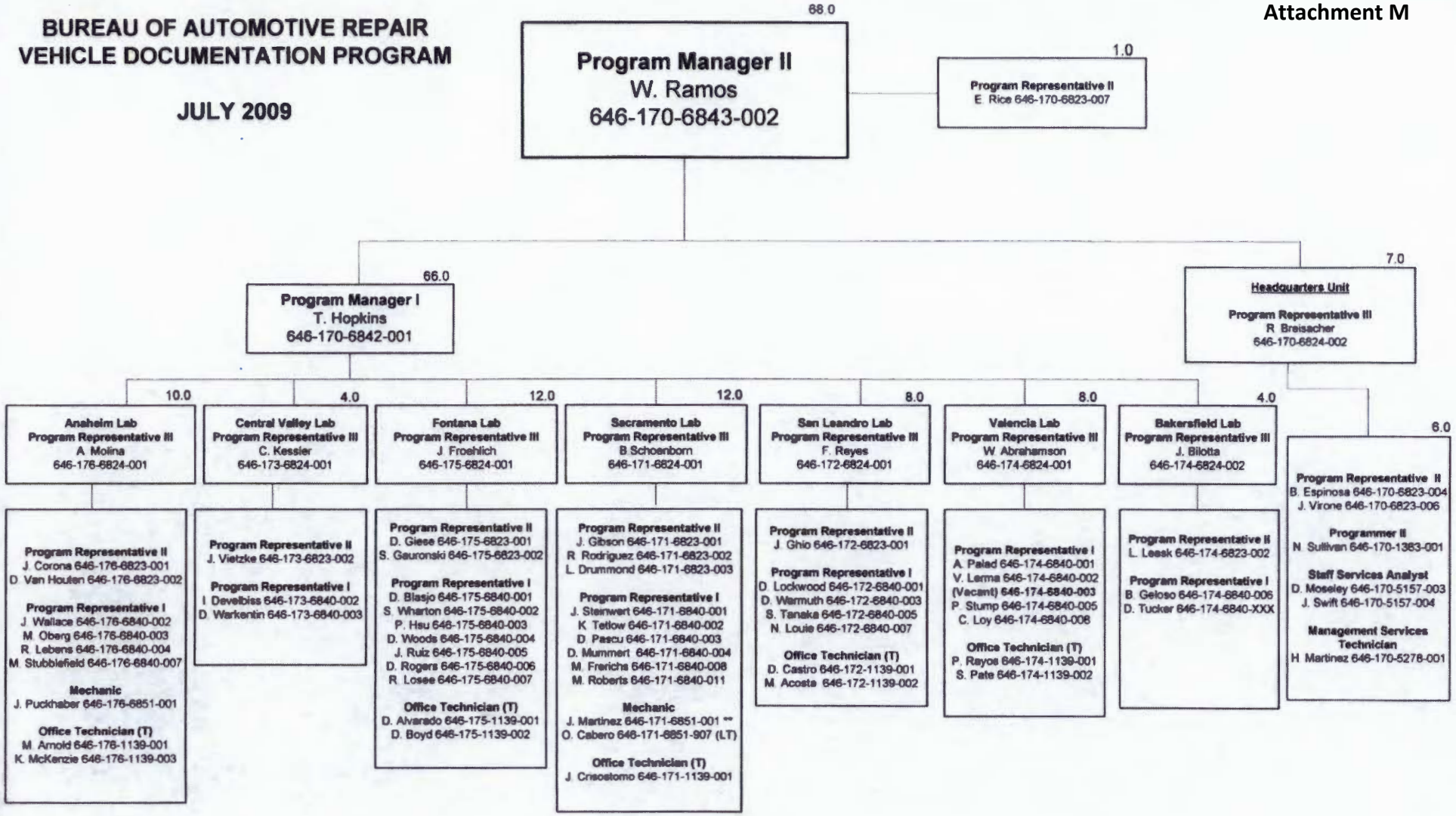
JULY 2009



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
VEHICLE DOCUMENTATION PROGRAM

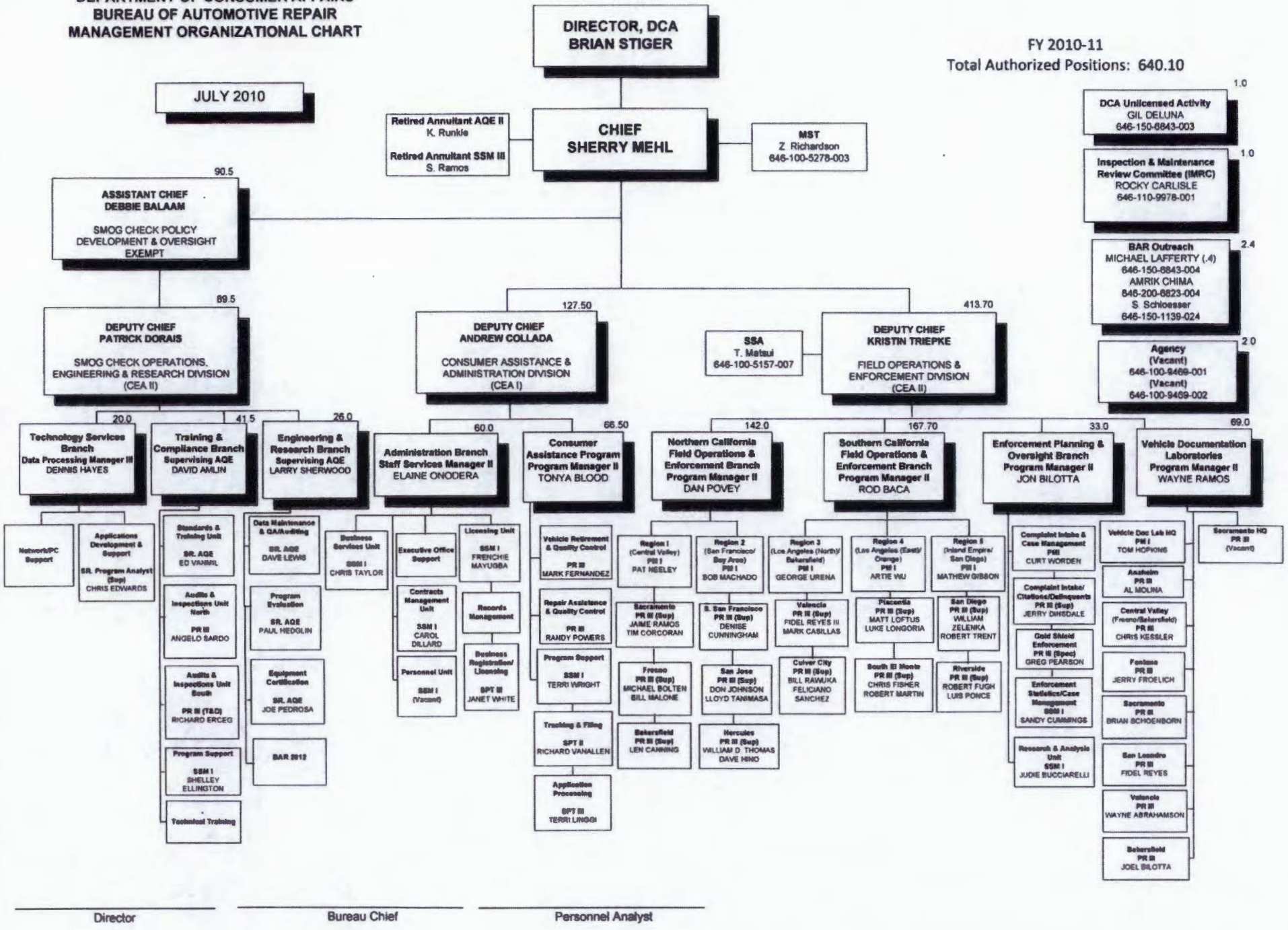
JULY 2009



** On loan to CAP

Attachment M

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
SMOG CHECK OPERATIONS, ENGINEERING & RESEARCH DIVISION

JULY 2010

90.50

ASSISTANT CHIEF
DEBBIE BALAAM **
SMOG CHECK POLICY DEVELOPMENT & OVERSIGHT
EXEMPT
646-121-8708-001

89.50

DEPUTY CHIEF
CEA II
PATRICK DORAIS
646-100-7500-001

Volunteer Project & Policy Coordinator
G. Hunter

1.0
Staff Services Analyst
T. Brazil 646-121-5157-007

20.0
TECHNOLOGY SERVICES BRANCH
Data Processing Manager III
D. Hayes 646-120-1393-001

10.0
Network/ PC Support
Senior Info Systems Analyst (Sup)
(Vacant) 646-121-1346-XXX
Senior Info Systems Analyst
T. Wulah 646-120-1337-001
PC Support
Assoc Info Systems Analyst
A. Fox 646-120-1470-006
G. Rice 646-121-1470-001
Assistant Info Systems Analyst
J. Nguyen 646-120-1479-001
Network Support
Assoc Info Systems Analyst
M. Fadling 646-120-1470-005
IT Procurement
Assistant Info Sys Analyst
J. Swift 646-121-1479-001
Service Desk
Program Technician II
D. Marshall 646-121-9928-001
D. Karr 646-121-9928-XXX
IT Support
Management Services Technician
F. Constantino 646-121-5278-002

9.0
Applications Development
Sr. Programmer Analyst (Sup)
C. Edwards 646 120-1584-001
Web Support
Assoc Programmer Analyst
S. Armstrong 646-120-1579-001
Application Support
Sr. Programmer Analyst
E. Yamamoto 646 120-1583-001
Staff Programmer Analyst
P. Frisbie 646-120-1581-001
A. Burhan 646-120-1581-003
Assoc Programmer Analyst
(Vacant) 610-710-1579-027
R. Pfand 610-710-1579-029
Staff Info Systems Analyst
K. Lai 646-121-1312-002
Assoc Info Systems Analyst
P. Meads 646-121-1470-002
Student Assistant
J. Rice 646-120-4870-907
NGET Support
Staff Info Systems Analyst
S. Beni 646-121-1312-001
Staff Services Analyst
E. Alejandre 646-121-5157-005

41.50
Training & Compliance Branch
Supervising Air Quality Engineer
D. Amlin 646-121-9944-001

14.0
Audits & Inspections Unit Northern California
Program Representative III (Sup)
A. Sardo 646-121-6824-001
Program Representative II
T. Seiler 646-121-6823-001
Program Representative I
E. Lopez 646-121-6840-005
J. Medlin 646-121-6840-006
D. Cassell 646-121-6840-007
M. Victorino 646-121-6840-008
C. Sells 646-121-6840-010
B. Wilson 646-121-6840-011
Roadsides
Program Representative I
W. Ahmed 646-121-6840-016
J. Cooper 646-121-6840-017
G. Prow 646-121-6840-018
Technical Training
Program Representative II
S. Buckley 646-121-6823-004
Program Representative I
M. Mahlke 646-121-6840-015
Office Technician (G)
C. Strickler 646-121-1138-002

16.50
Audits & Inspections Unit Southern California
Air Quality Engineer I
R. Erceg 646-121-9941-018
Program Representative I
B. Marshall 646-121-6840-001
G. Magana 646-121-6840-002
M. Tse 646-121-6840-003
G. Elsayed 646-121-6840-004
D. Bramer 646-121-6840-009
G. Flores 646-121-6840-012
S. Allen 646-121-6840-013
B. Swanson 646-121-6840-014 (.5)
Roadsides
Air Quality Representative I
J. Opjorden 646-121-9261-003
D. Dowding 646-121-9261-009
K. Russell 646-121-9261-011
U. Carlos 646-121-9261-013
Technical Training
Program Representative II
P. Thomas 646-121-6823-002
M. Warnock 646-121-6823-003
R. Badham 646-210-6823-001
Office Technician (T)
L. Ayala 646-121-1139-001

5.0
Program Support
Staff Services Manager I
S. Ellington 646-121-4800-001
Assoc Gov Program Analyst
J. Truong 646-121-5393-005
R. Garcia 646-121-5393-907 **
Staff Services Analyst
R. Becker Jr. 646-121-5157-006
P. Stickney 646-121-5157-008
Office Technician (G)
M. Kelso 646-121-1138-001

5.0
Standards & Training Unit
Sr. Air Quality Engineer
E. VanMil 646-121-9943-002
Air Quality Engineer I
C. Jang 646-121-9941-013
Training
Air Quality Engineer II
G. Garrett 646-122-9942-003
Exam Development
Air Quality Engineer I
K. Harris 646-122-9941-002
Referee Operations
Air Quality Engineer I
D. Burnett 646-122-9941-003

26.0
Engineering & Research Branch
Supervising Air Quality Engineer
L. Sherwood 646-121-9944-003

6.0
Data Maintenance & QA/ Auditing
Sr. Air Quality Engineer
D. Lewis 646-121-9943-004

6.0
Program Evaluation
Sr. Air Quality Engineer
P. Hedglin 646-121-9943-003

7.0
Equipment Certification
Sr. Air Quality Engineer
J. Pedrosa 646-121-9943-001

4.0
BAR 2012
Air Quality Engineer II
G. Sweet (Lead) 646-121-9942-015
L. Luther 646-121-9942-004
B. Benjaminson 646-121-9942-013
Air Quality Engineer I
J. Gee 646-121-9941-019

2.0
Staff Services Analyst
T. Jenkins 646-121-5157-001
Office Technician (G)
K. Avila-Ellington 646-121-1138-003

Air Quality Engineer II
T. Lenzie 646-121-9942-002
G. Kubik 646-121-9942-005
Air Quality Engineer I
M. Rubin 646-121-9941-006
P. Graham 646-121-9941-021
M. Perona 646-121-9941-022

Air Quality Engineer II
G. Torgerson 646-121-9942-003
M. Yang 646-121-9942-006
G. Coburn 646-121-9942-010
R. Gallavan 646-121-9942-012
Air Quality Engineer I
N. Champlin 646-121-9941-001

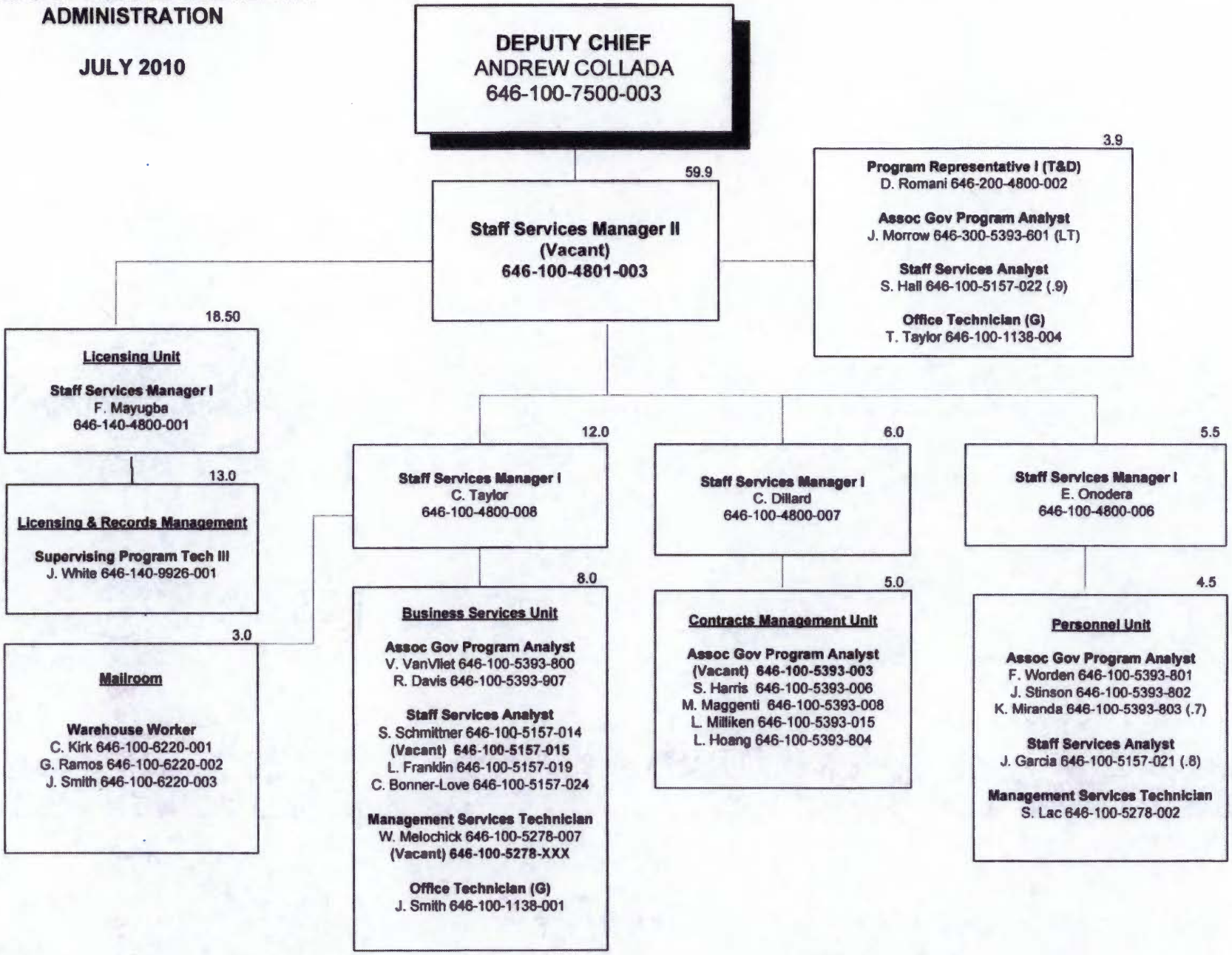
Air Quality Engineer II
D. Shankute 646-121-9942-007
M. Duewel 646-121-9942-014
Air Quality Engineer I
W. Freese 646-121-9941-002
G. Clinciu 646-121-9941-011
C. Upton 646-121-9941-014
P. Chand 646-121-9941-015

** On temporary assignment to DCA

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

JULY 2010



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

JULY 2010

DEPUTY CHIEF
ANDREW COLLADA
646-100-7500-003

65.50

Program Manager II
T. Blood
646-200-6843-001

37.0

Program Support

Staff Services Manager I
T. Wright 646-200-4800-001

4.0

Program Analysis

Assoc Gov Program Analyst
N. Sullivan 646-200-5393-012

Staff Services Analyst
V. Manning 646-200-5157-006
V. Somma 646-200-5157-009
(Vacant) 646-200-5157-XXX

Youth Aid
K. Ramirez 646-200-9991-907

Application Processing

Supervising Program Tech III
T. Linggi 646-200-9926-003

Application Processing/ Deficiency & Re-Evaluation Unit

Program Technician III
R. Basped 646-200-9929-003
(Vacant) 646-200-9929-004
B. Poole 646-200-9929-005
Program Technician II
T. Odabashian 646-200-9928-003
S. Lloyd 646-200-9928-004
C. Beaslin 646-200-9928-011
M. Dennis 646-200-9928-017
T. Le 646-200-9928-018 (.5)
M. Nguyen 646-200-9928-019
Program Technician
C. Hudson 646-200-9927-003
B. Spencer 646-200-9927-021
Student Assistant
C. Seawell 646-200-4870-907
G. Martucci 646-200-4870-907

Invoice Processing & Approval Unit

Management Services Technician
M. Epstein 646-200-5278-004
R. Parmenter 646-200-5278-008
S. Lathum 646-200-5278-009
R. Macias 646-200-5278-018

Office Technician (T)
H. Merrifield 646-200-1139-005

Student Assistant
A. Meier
646-200-4870-907

15.50

Tracking & Filing

Supervising Program Tech II
R. VanAllen 646-200-9925-002 *

CAP Phone Information Center & Support Staff Unit

Program Technician II
A. Harmon 646-200-9928-008
C. Gomez 646-200-9928-012
B. Schleicher 646-200-9928-015
(Vacant) 646-300-9928-XXX LT
Program Technician
A. Nolan 646-200-9927-017
N. Kelly 646-200-9927-022 *
F. Gomez 646-200-9927-023 *

CAP File Management & Retrieval Unit

Office Assistant (T)
B. Briones 646-200-1379-011
Office Assistant (G)
J. Roberts 646-200-1441-007

Mail Process & CAP Support Services

Office Technician (T)
C. Osorio 646-200-1139-009
S. Rankin 646-300-1139-600 LT
S. Curchin 646-300-1139-601 LT
S. Washburn 646-300-1139-602
A. Christian 646-300-1139-603 (.5) LT
Program Technician II
T. Corsbie 646-200-9928-020

18.6

Technical Services

Program Representative III (Sup)
R. Powers 646-200-6824-003

Repair Assistance & Quality Control Unit

Program Representative II
N. Strever 646-200-6823-001

Program Representative I
H. Sam 646-200-6840-001
P. Dietler 646-200-6840-003
R. Powers 646-200-6840-006
D. Juarez 646-200-6840-010
F. Hemati 646-200-6840-019
P. Lessard 646-200-6840-033
D. Moreau 646-200-6840-038
E. Oback 646-200-6840-039
T. Smith 646-200-6840-041
J. Santos 646-200-6840-044
J. Horton 646-200-6840-045 (.6)

Fax Room Unit/Support

Office Technician (T)
D. Partner 646-200-1139-002
L. Coones 646-200-1139-010 **

Office Technician (G)
M. Leyva 646-200-1138-002
J. Van Sant 646-200-1138-003
C. Beatty 646-200-1138-004

Office Assistant (G)
T. Gwarada 646-200-1441-012

9.0

Technical Services

Program Representative III (Sup)
M. Fernandez 646-200-6824-002

Vehicle Retirement & Quality Control Unit

Program Representative II
M. Homdus 646-200-6823-002

Program Representative I
L. Kyle 646-200-6840-018
T. Matoba 646-200-6840-021
R. Meyer 646-200-6840-036
H. Pittman 646-200-6840-040

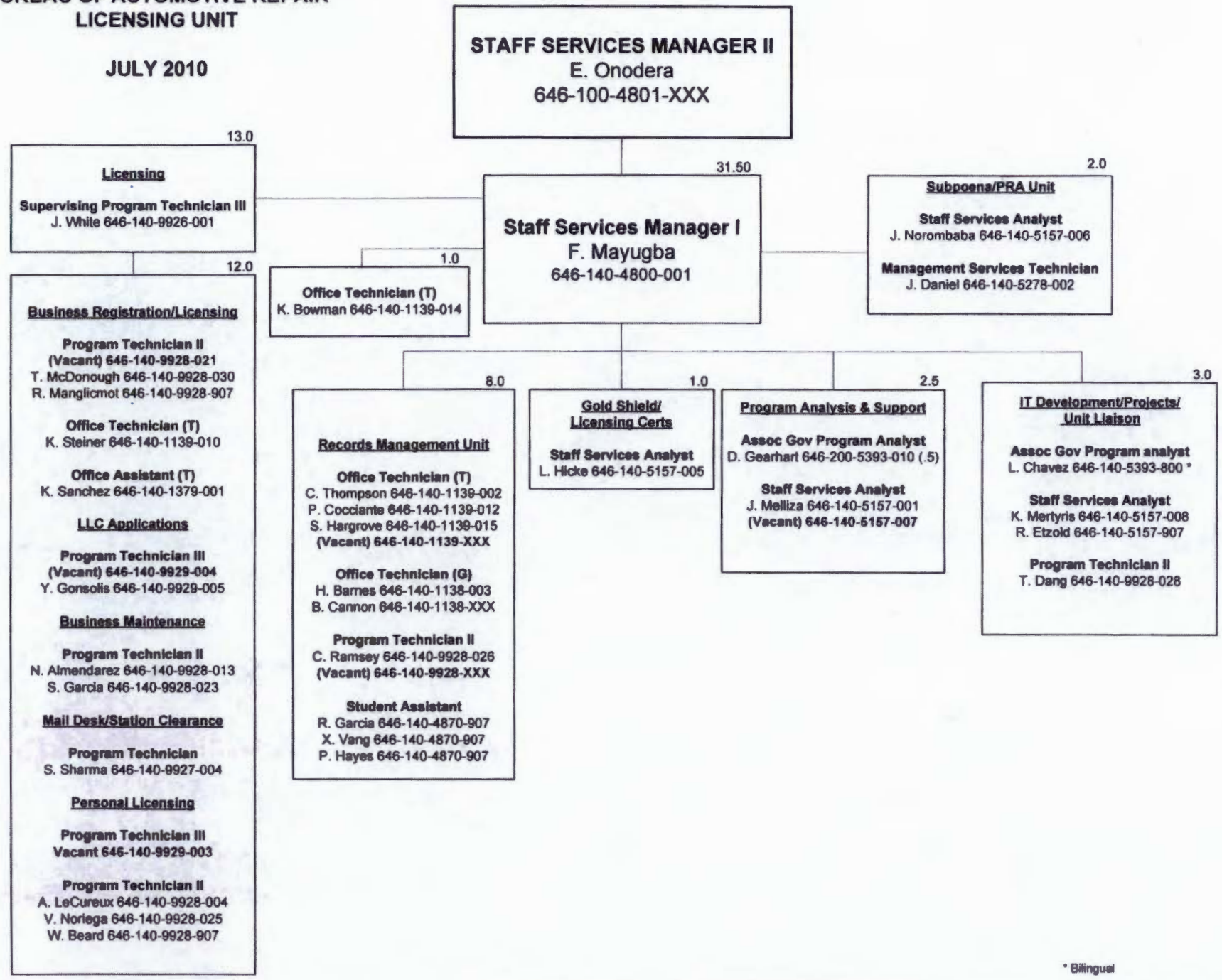
Assoc Gov Program Analyst
E. Cepin 646-200-5393-009
(Vacant) 646-300-5393-600 LT

Management Services Technician
D. Kosanovic 646-200-5278-017

* Bilingual
** On loan to Licensing

BUREAU OF AUTOMOTIVE REPAIR
LICENSING UNIT

JULY 2010



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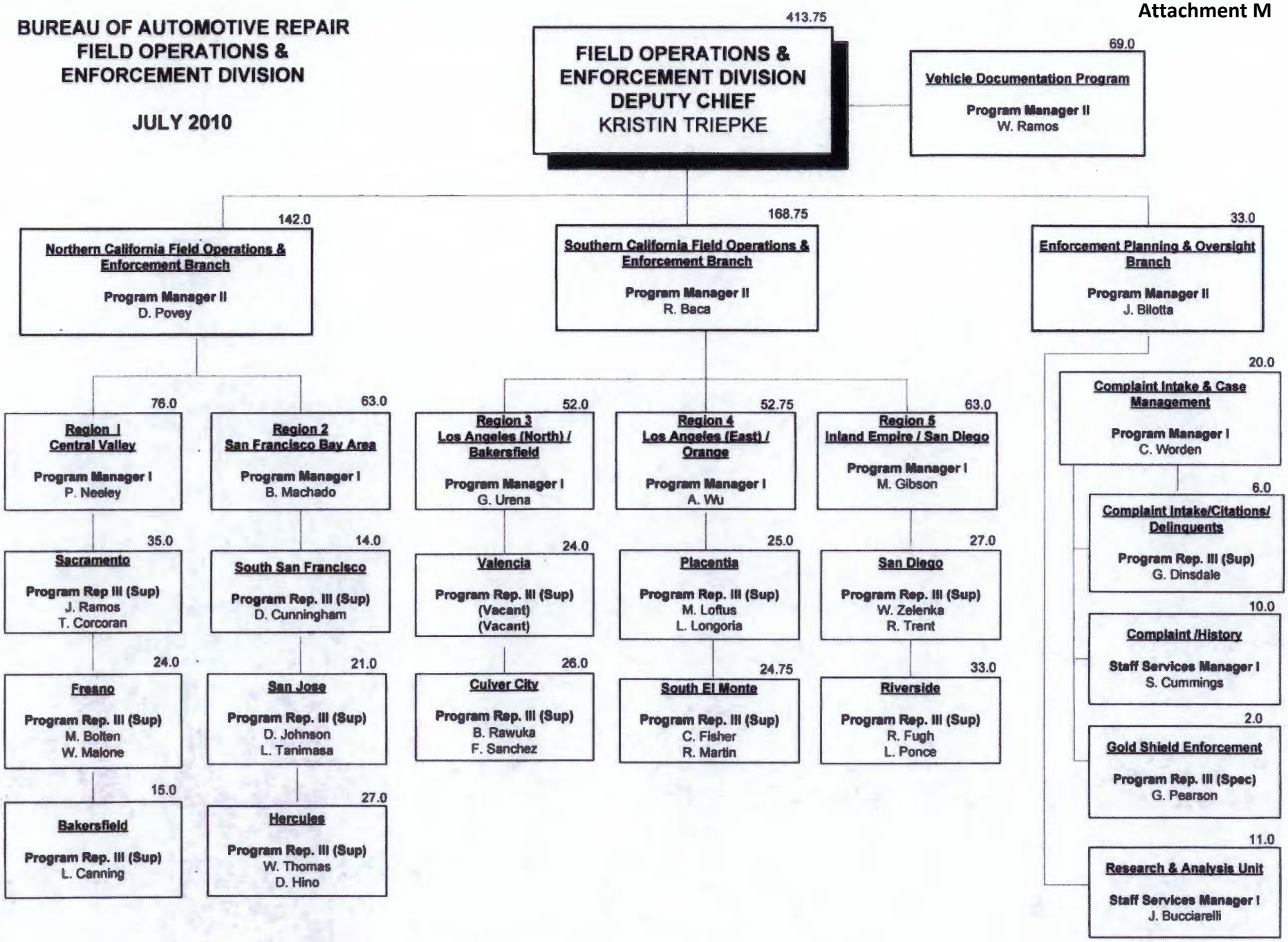
Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

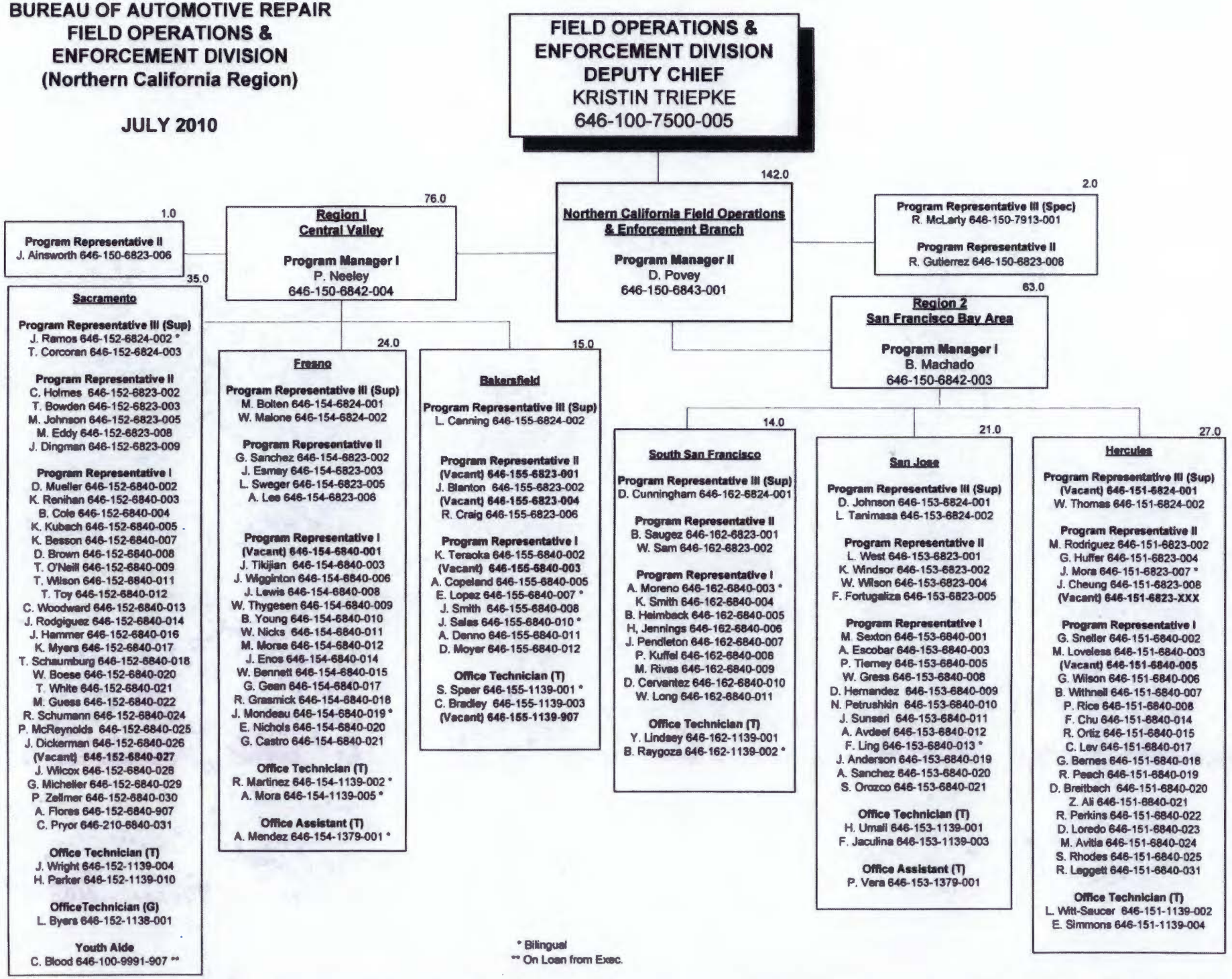
JULY 2010



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

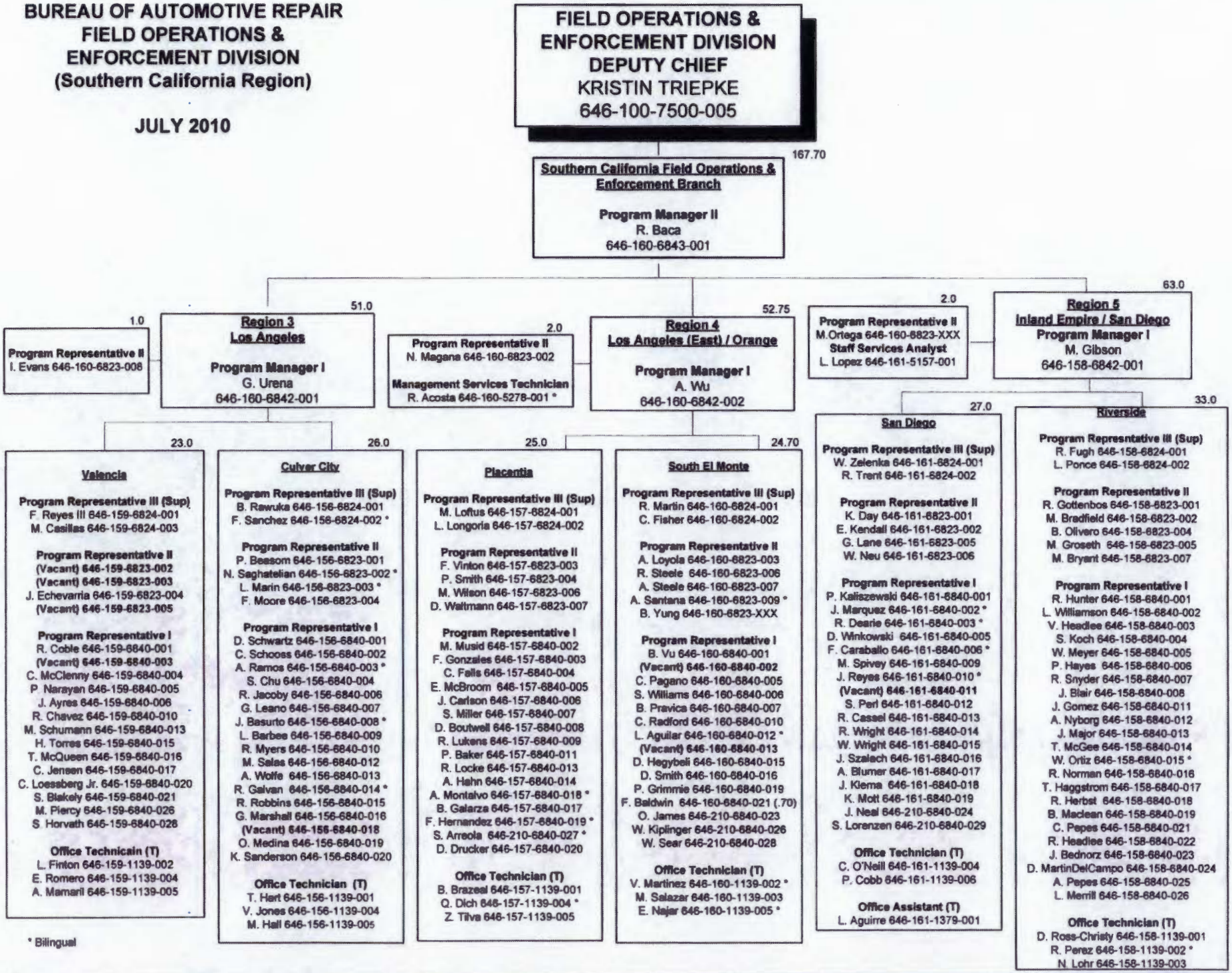
JULY 2010



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

JULY 2010

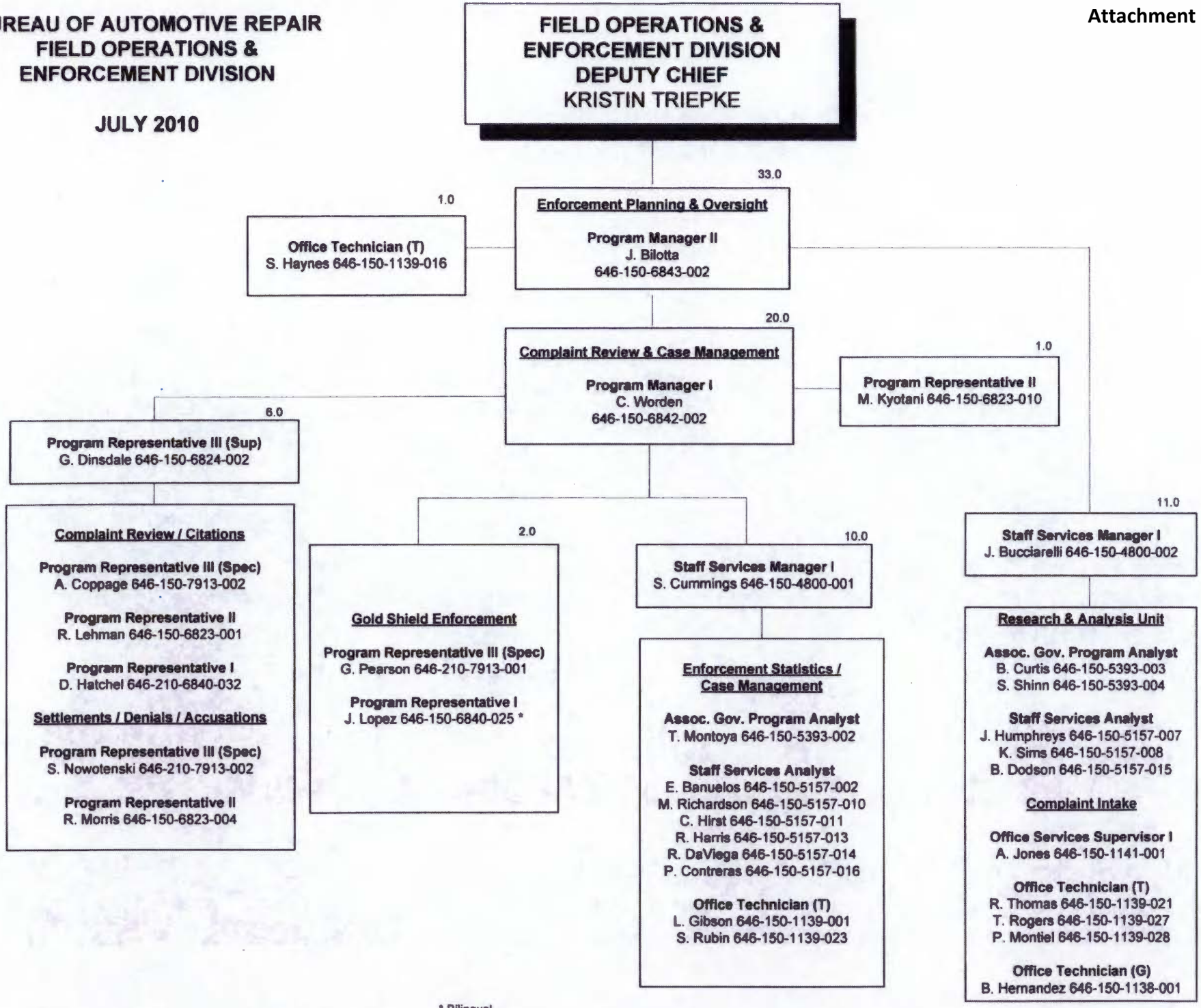


* Bilingual

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

JULY 2010

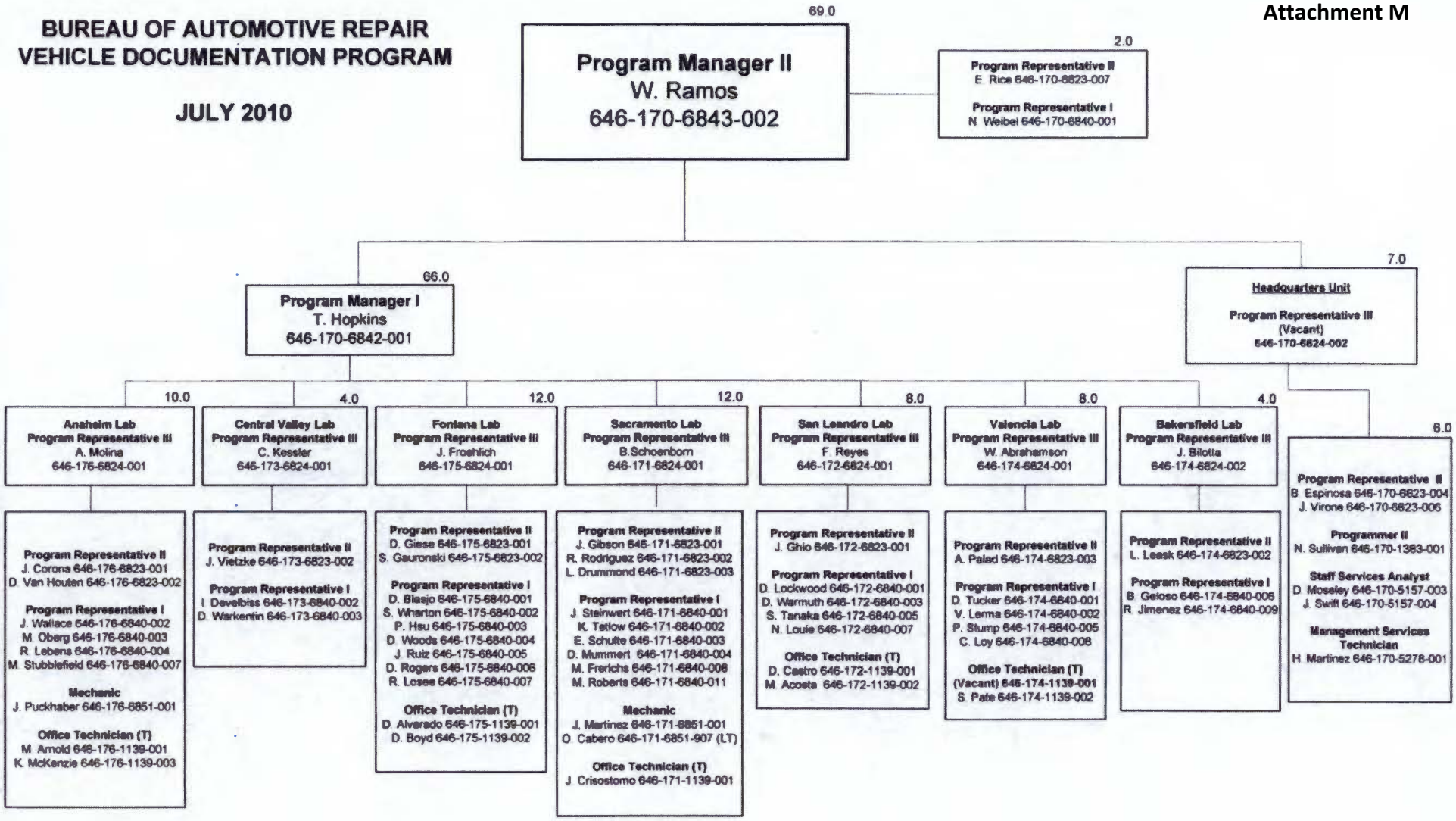


* Bilingual

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
VEHICLE DOCUMENTATION PROGRAM

JULY 2010

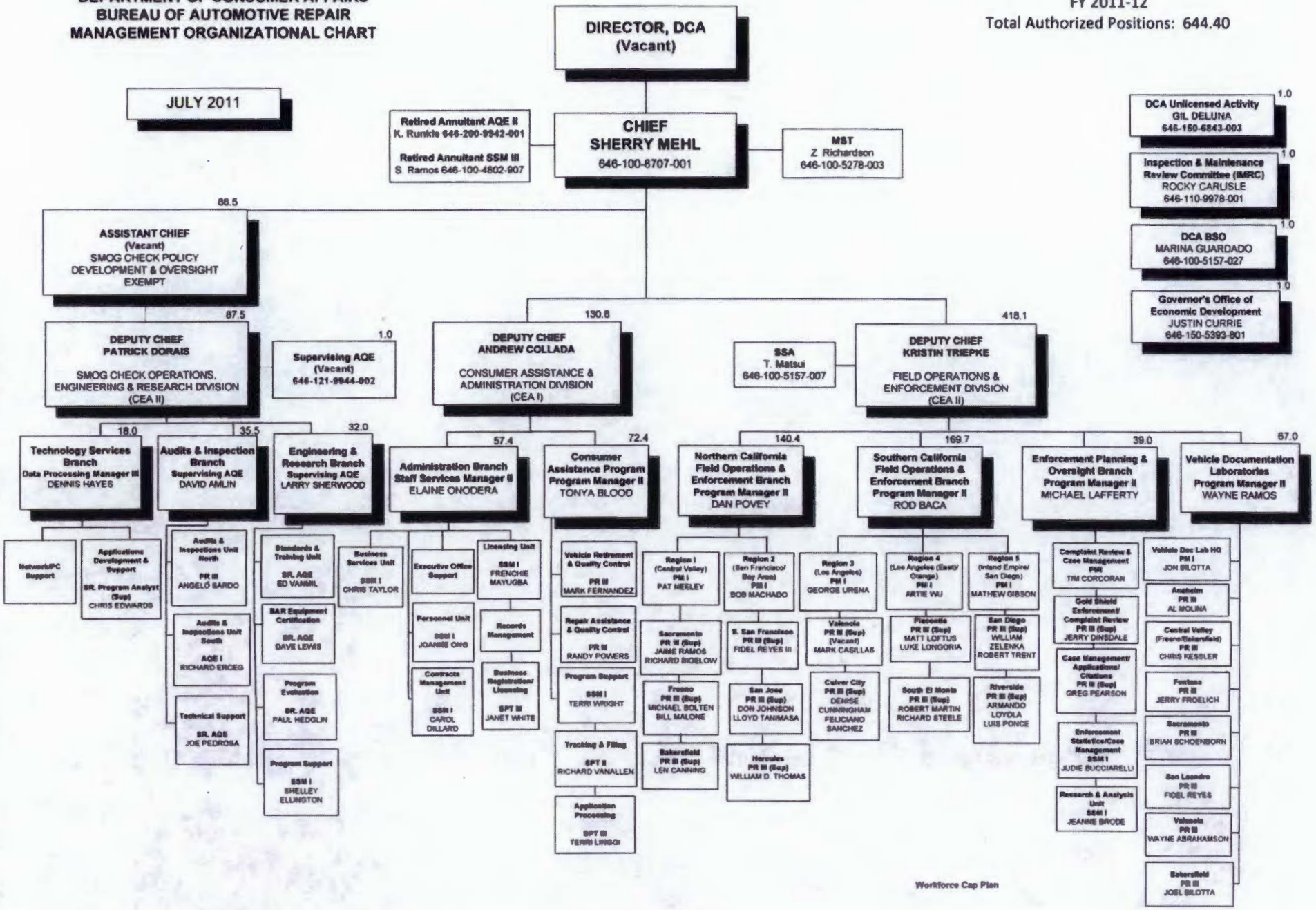


Attachment M

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART

FY 2011-12
Total Authorized Positions: 644.40

JULY 2011

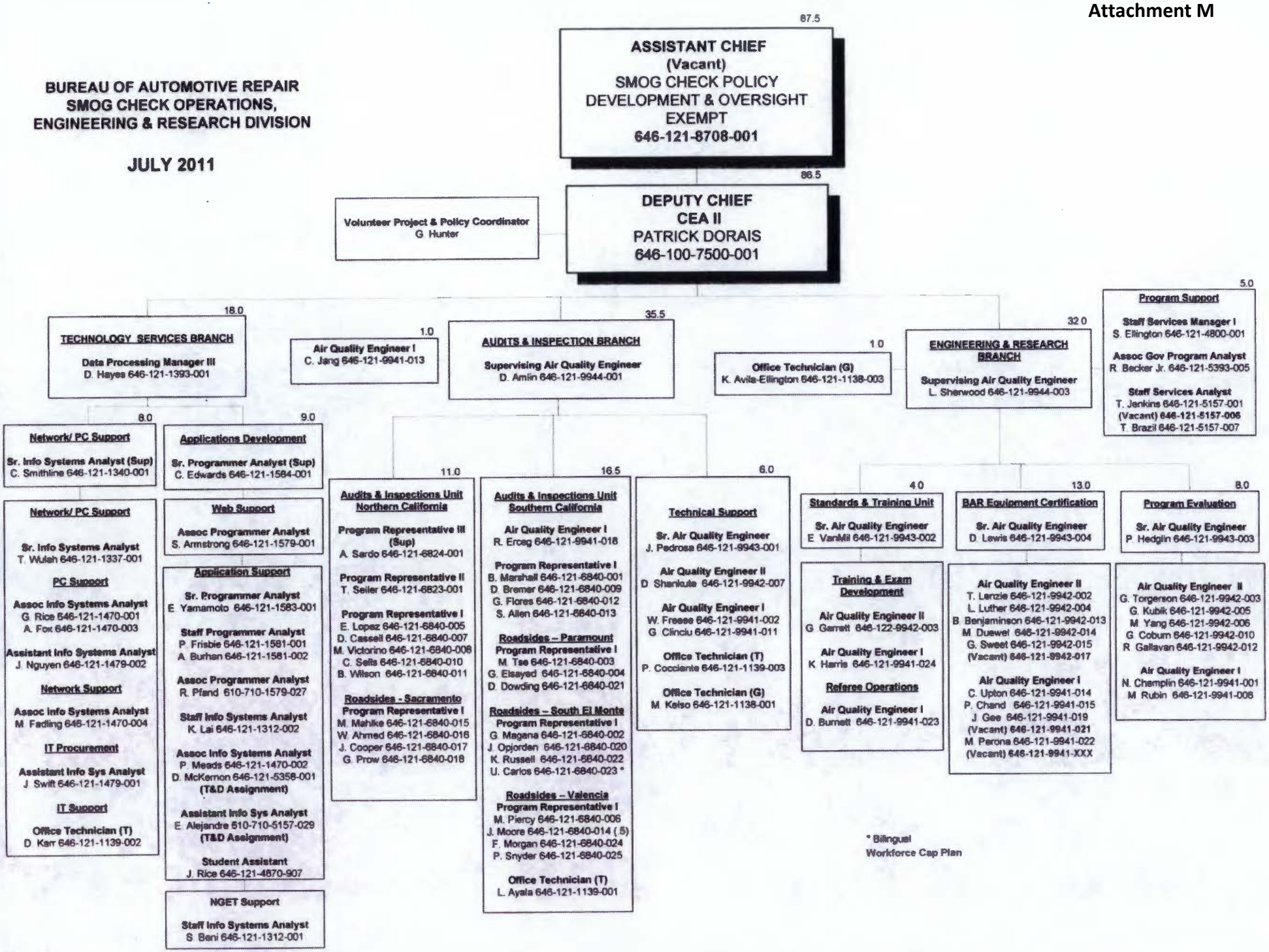


Workforce Cap Plan

Attachment M

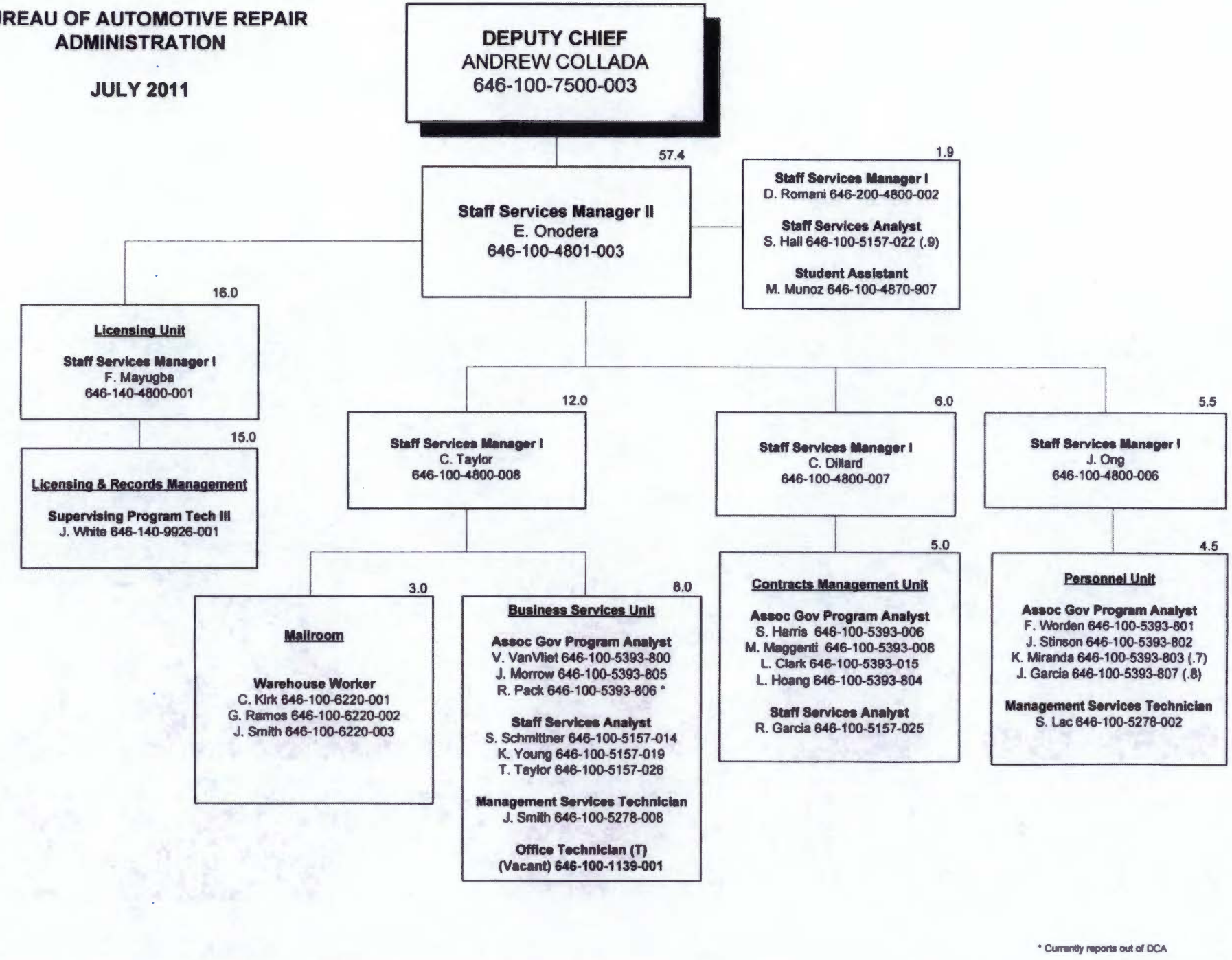
BUREAU OF AUTOMOTIVE REPAIR
SMOG CHECK OPERATIONS, ENGINEERING & RESEARCH DIVISION

JULY 2011



BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

JULY 2011



* Currently reports out of DCA

BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

JULY 2011

DEPUTY CHIEF
ANDREW COLLADA
646-100-7500-003

72.4

Program Manager II
T. Blood 646-200-6843-001

Student Assistant
A. Meier 646-200-4870-907

35.8

Program Support Division

Staff Services Manager I
T. Wright 646-200-4800-001

Program Technical Assistance Unit 1.5

Air Quality Engineer II
(Vacant) 646-300-9942-XXX LT
(Vacant) 646-300-9942-XXX (.50) LT

3.0

Program Analysis Unit

Assoc Gov Program Analyst
N. Sullivan 646-200-5393-012

Staff Services Analyst
V. Manning 646-200-5157-006
(Vacant) 646-200-5157-009

Youth Aid
K. Ramirez 646-200-9991-907

18.0

Application Processing Unit

Supervising Program Tech III
T. Linggi 646-200-9926-003

13.8

Tracking & Filing Unit

Supervising Program Tech II
R. VanAllen 646-200-9925-002 *

18.6

Technical Services Unit

Program Representative III (Sup)
R. Powers 646-200-6824-003

15.5

Technical Services Unit

Program Representative III (Sup)
M. Fernandez 646-200-6824-002

Application Processing/ Deficiency & Re-Evaluation

Program Technician III
R. Basped 646-200-9929-003
(Vacant) 646-200-9929-005

Program Technician II
T. Odabashian 646-200-9928-003
C. Beaslin 646-200-9928-011
(Vacant) 646-200-9928-015
M. Dawicki 646-200-9928-017
S. Lloyd 646-200-9928-018
M. Nguyen 646-200-9928-019
T. Le 646-200-9928-021
(Vacant) 646-200-9928-XXX
Vacant) 646-300-9928-XXX LT
(Vacant) 646-300-9928-XXX LT
(Vacant) 646-300-9928-XXX LT

Program Technician
C. Hudson 646-200-9927-003

Student Assistant
C. Seawell 646-200-4870-907

CAP Phone Information Center & Support Staff

Program Technician II
(Vacant) 646-200-9928-008
C. Gomez 646-200-9928-012
(Vacant) 646-300-9928-600 LT
(Vacant) 646-300-9928-XXX LT
(Vacant) 646-300-9928-XXX LT
(Vacant) 646-300-9928-XXX LT (.30)

Program Technician
A. Nolan 646-200-9927-017
N. Kelly 646-200-9927-022 *
F. Gomez 646-200-9927-023 *

Repair Assistance & Quality Control

Program Representative II
N. Strever 646-200-6823-001
(Vacant) 646-200-6823-004

Program Representative I
H. Sam 646-200-6840-001
P. Dietler 646-200-6840-003
R. Powers 646-200-6840-006
D. Juarez 646-200-6840-010
F. Hemati 646-200-6840-019
D. Moreau 646-200-6840-038
E. Oback 646-200-6840-039
T. Smith 646-200-6840-041
J. Santos 646-200-6840-044
(Vacant) 646-200-6840-045 (.60)

Vehicle Retirement & Quality Control

Program Representative II
M. Homdus 646-200-6823-002

Program Representative I
L. Kyle 646-200-6840-018
T. Matoba 646-200-6840-021
R. Meyer 646-200-6840-036
H. Pittman 646-200-6840-040
(Vacant) 646-300-6840-XXX LT
(Vacant) 646-300-6840-XXX LT
(Vacant) 646-300-6840-XXX LT
(Vacant) 646-300-6840-XXX LT

Assoc Gov Program Analyst
E. Cepin 646-200-5393-009
(Vacant) 646-300-5393-601 LT
(Vacant) 646-300-5393-XXX LT
(Vacant) 646-300-5393-XXX (.50) LT

Management Services Technician
D. Kosanovic 646-200-5278-017

Office Technician (G)
(Vacant) 646-300-1138-600 LT

Invoice Processing & Approval

Management Services Technician
R. Parmenter 646-200-5278-008
S. Lathum 646-200-5278-009

Office Technician (T)
H. Merrifield 646-200-1139-005

Mail Process & CAP Support Services

Office Technician (T)
S. Rankin 646-300-1139-600 LT
R. Manglicmot 646-300-1139-601 LT
S. Washburn 646-300-1139-602 LT
(Vacant) 646-300-1139-603 (.50) LT

Program Technician II
T. Corsbie 646-200-9928-020

Fax Room & Staff Support

Office Technician (T)
D. Partner 646-200-1139-002

Office Technician (G)
M. Leyva 646-200-1138-002
J. Van Sant 646-200-1138-003
C. Beatty 646-200-1138-004

CAP File Management & Retrieval

Office Assistant (T)
B. Briones 646-200-1379-011

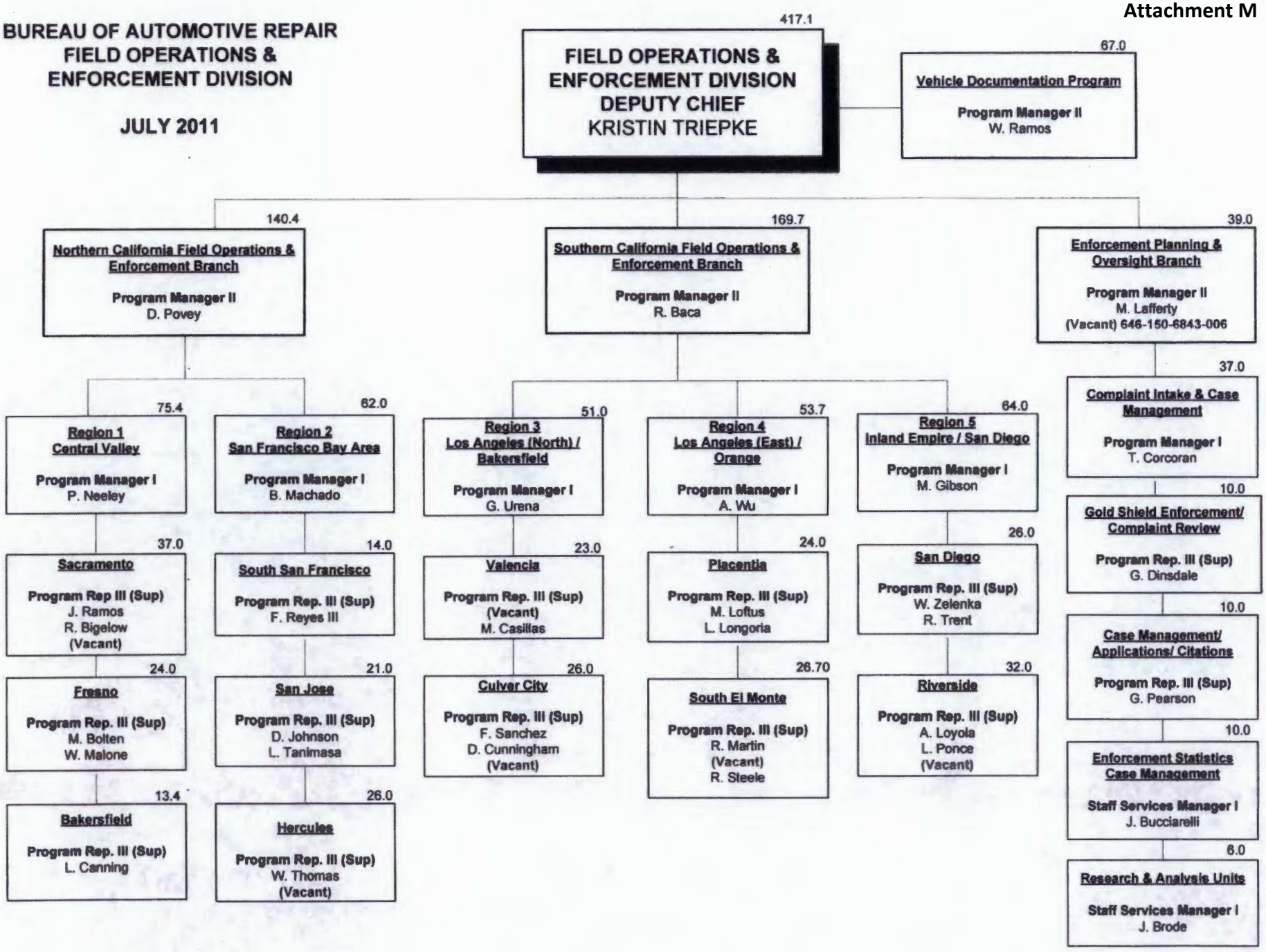
Office Assistant (G)
J. Robarts 646-200-1441-007

BCP/LT 2010/2011 Positions
BCP/LT 2011/2012 Positions
Workforce Cap Plan

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

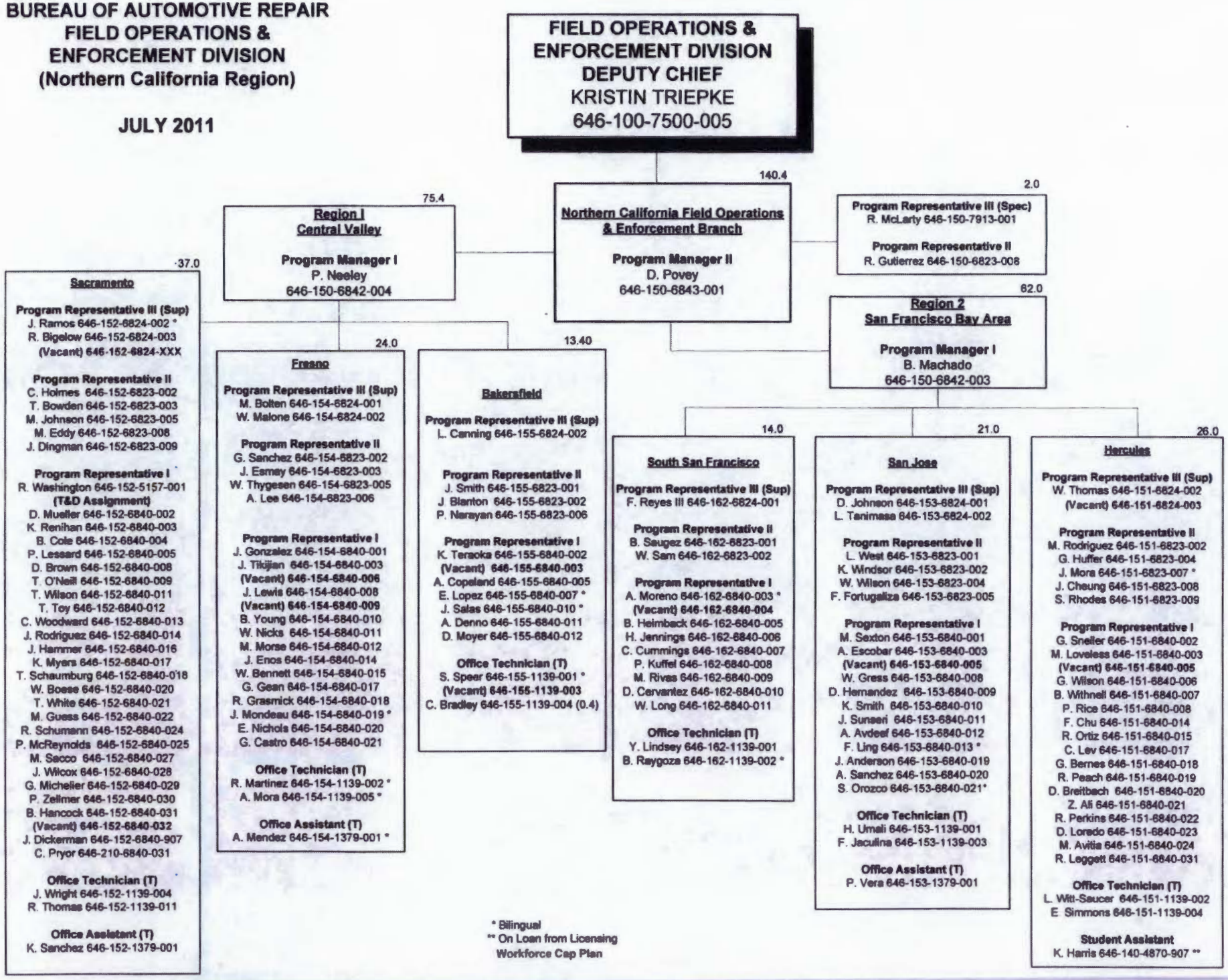
JULY 2011



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

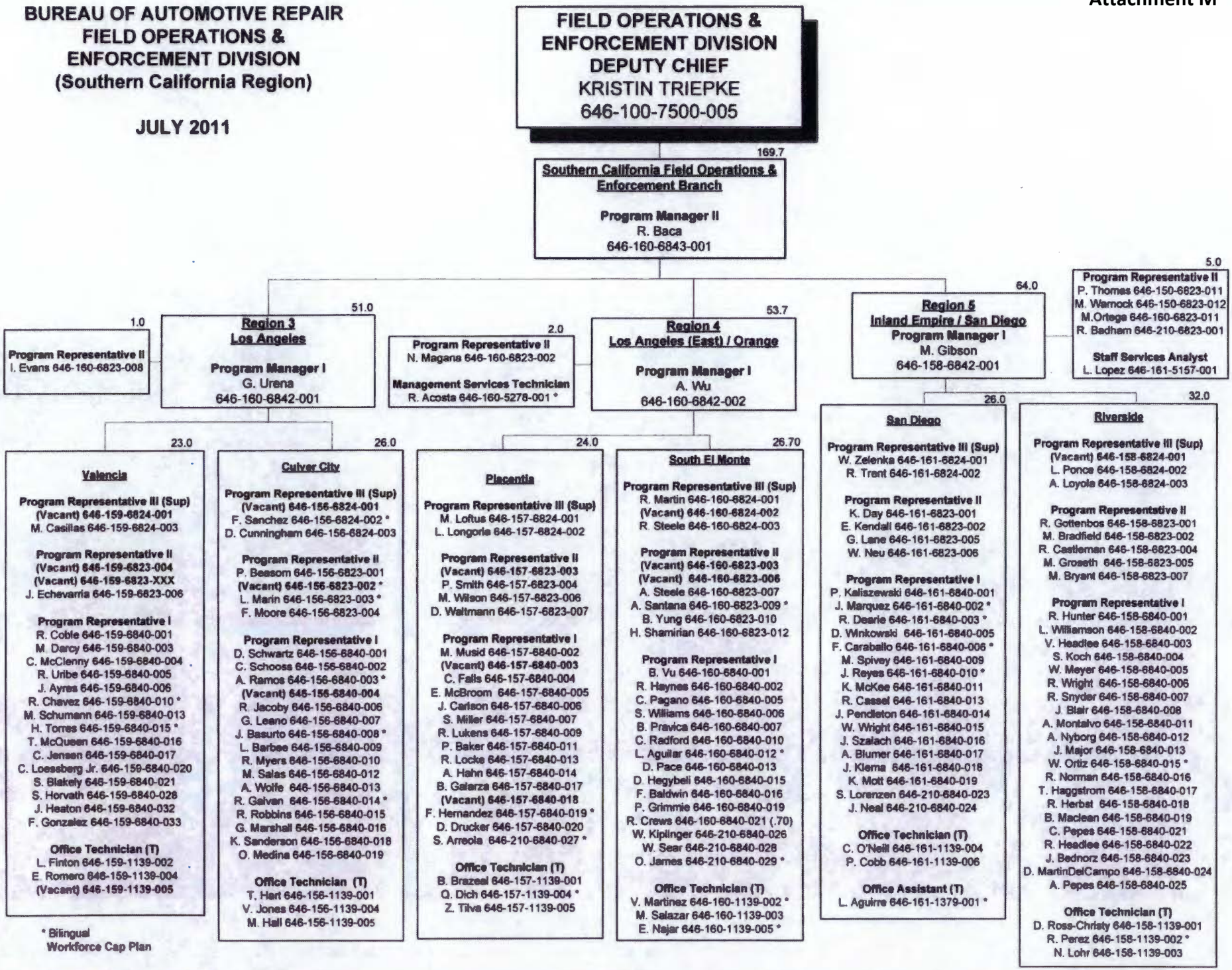
JULY 2011



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

JULY 2011



* Bilingual
Workforce Cap Plan

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

JULY 2011

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
KRISTIN TRIEPKE

39.0

Enforcement Planning & Oversight

Program Manager II
M. Lafferty
646-150-6843-002
(Vacant) 646-150-6843-006

37.0

Complaint Review & Case Management

Program Manager I
T. Corcoran
646-150-6842-002

10.0

Program Representative III (Sup)
G. Dinsdale 646-150-6824-002

Gold Shield Enforcement/Complaint Review

Program Representative III (Spec)
A. Coppage 646-150-7913-002

Program Representative II
A. Chima 646-150-6823-010
W. Cooper 646-150-6823-014

Program Representative I
(Vacant) 646-150-6840-025
D. Hatchel 646-210-6840-032

Complaint Intake

Office Services Supervisor I
A. Jones 646-150-1141-001

Office Technician (T)
(Vacant) 646-150-1139-027
P. Montiel 646-150-1139-028

Office Technician (G)
B. Hernandez 646-150-1138-001

10.0

Program Representative III (Sup)
G. Pearson 646-150-6824-003

Case Management/Applications/ Citations

Program Representative III (Spec)
S. Nowotenski 646-210-7913-002
(Vacant) 646-150-7913-XXX

Program Representative II
R. Lehman 646-150-6823-001
M. Kyotani 646-150-6823-004
J. Ainsworth 646-150-6823-006
R. Morris 646-150-6823-907
J. Lopez 646-210-6823-002 *

Assoc Gov Program Analyst
T. Montoya 646-150-5393-002
R. Harris 646-150-5393-801

Office Technician (T)
S. Haynes 646-150-1139-016

10.0

Staff Services Manager I
(Vacant) 646-150-4800-001
J. Bucciarelli 646-150-4800-002

Enforcement Statistics

Assoc. Gov. Program Analyst
B. Curtis 646-150-5393-003

Staff Services Analyst
D. Holmes 646-150-5157-002
M. Richardson 646-150-5157-010
C. Hirst 646-150-5157-011
R. DaVeiga 646-150-5157-014
P. Contreras 646-150-5157-016

Office Technician (T)
L. Gibson 646-150-1139-001
S. Rubin 646-150-1139-023

6.0

Staff Services Manager I
J. Brode 646-150-4800-003

Research & Analysis Unit

Assoc. Gov. Program Analyst
S. Shinn 646-150-5393-004
C. Bonner-Love 646-150-5393-800

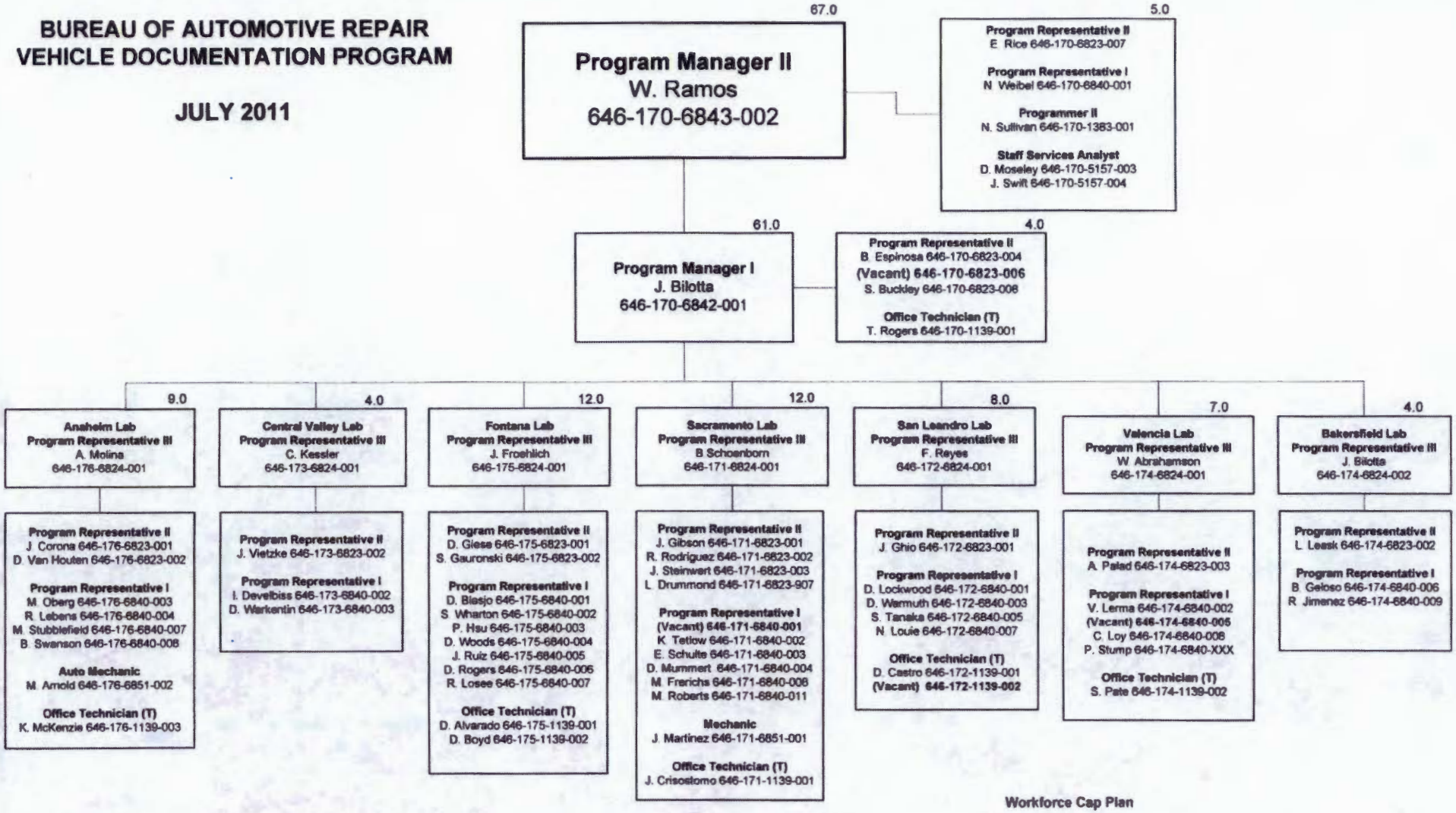
Staff Services Analyst
J. Humphreys 646-150-5157-007
(Vacant) 646-150-5157-013
B. Dodson 646-150-5157-015

* Bilingual
Workforce Cap Plan

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
VEHICLE DOCUMENTATION PROGRAM

JULY 2011



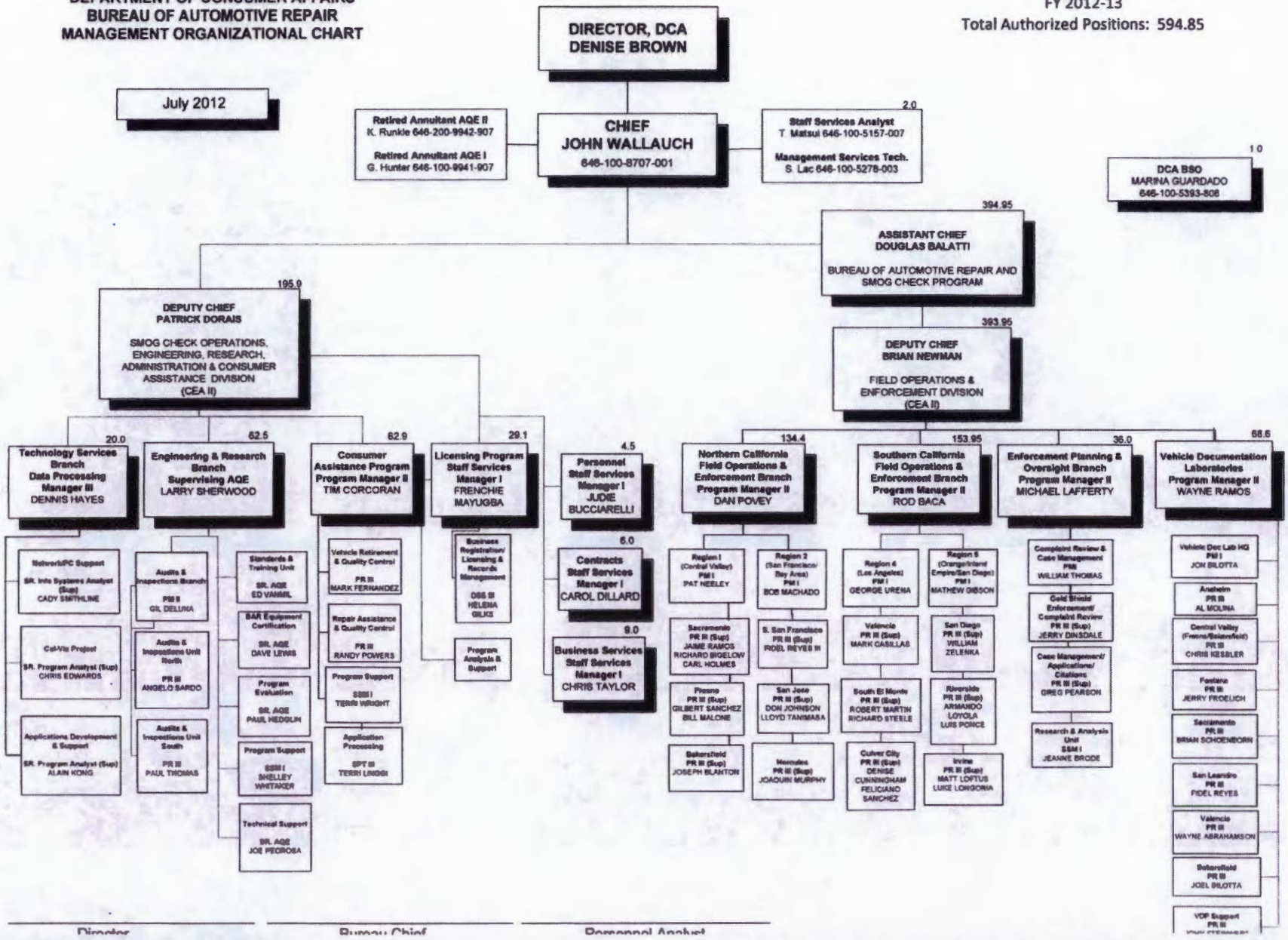
Workforce Cap Plan

Attachment M

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART

FY 2012-13
Total Authorized Positions: 594.85

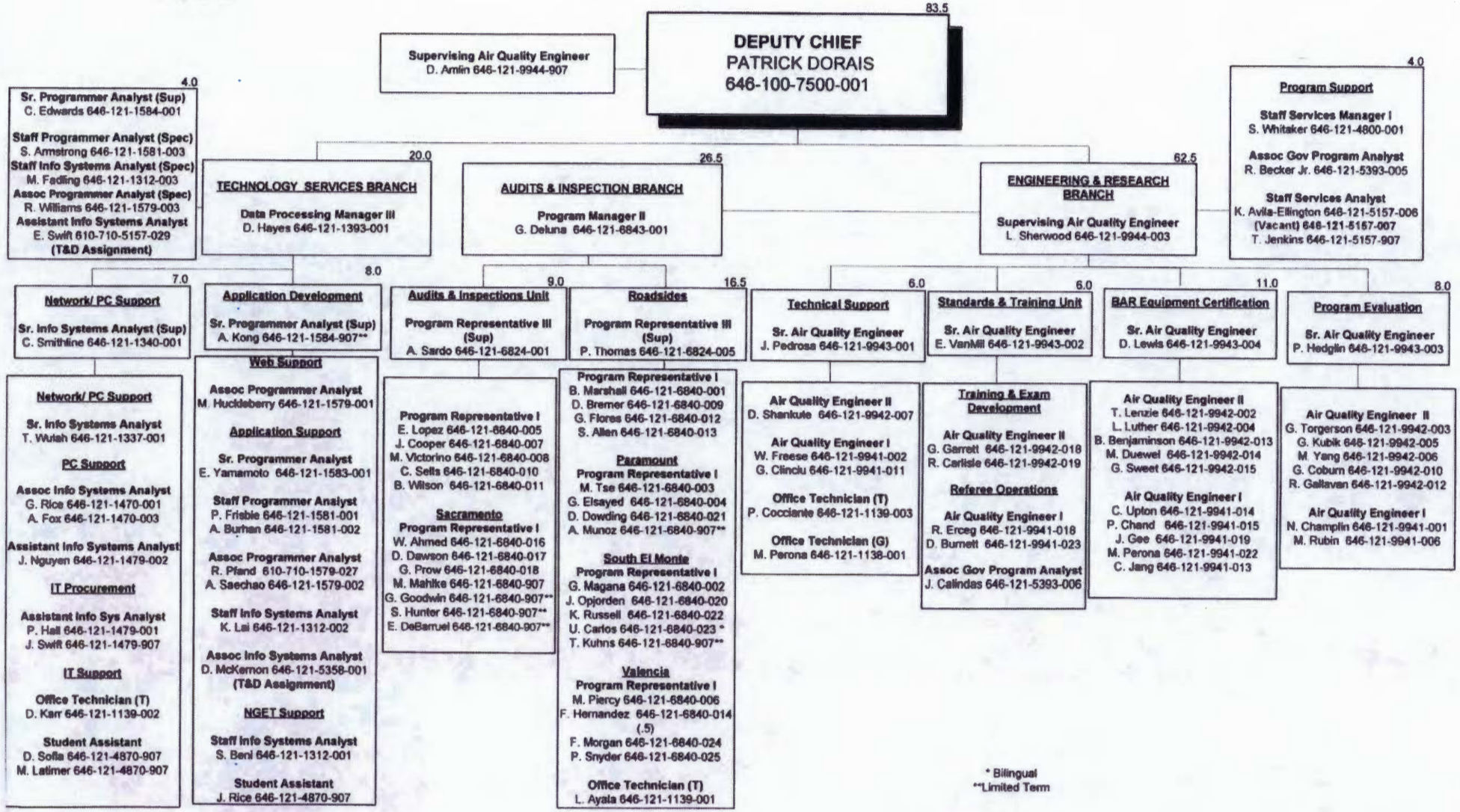
July 2012



Attachment M

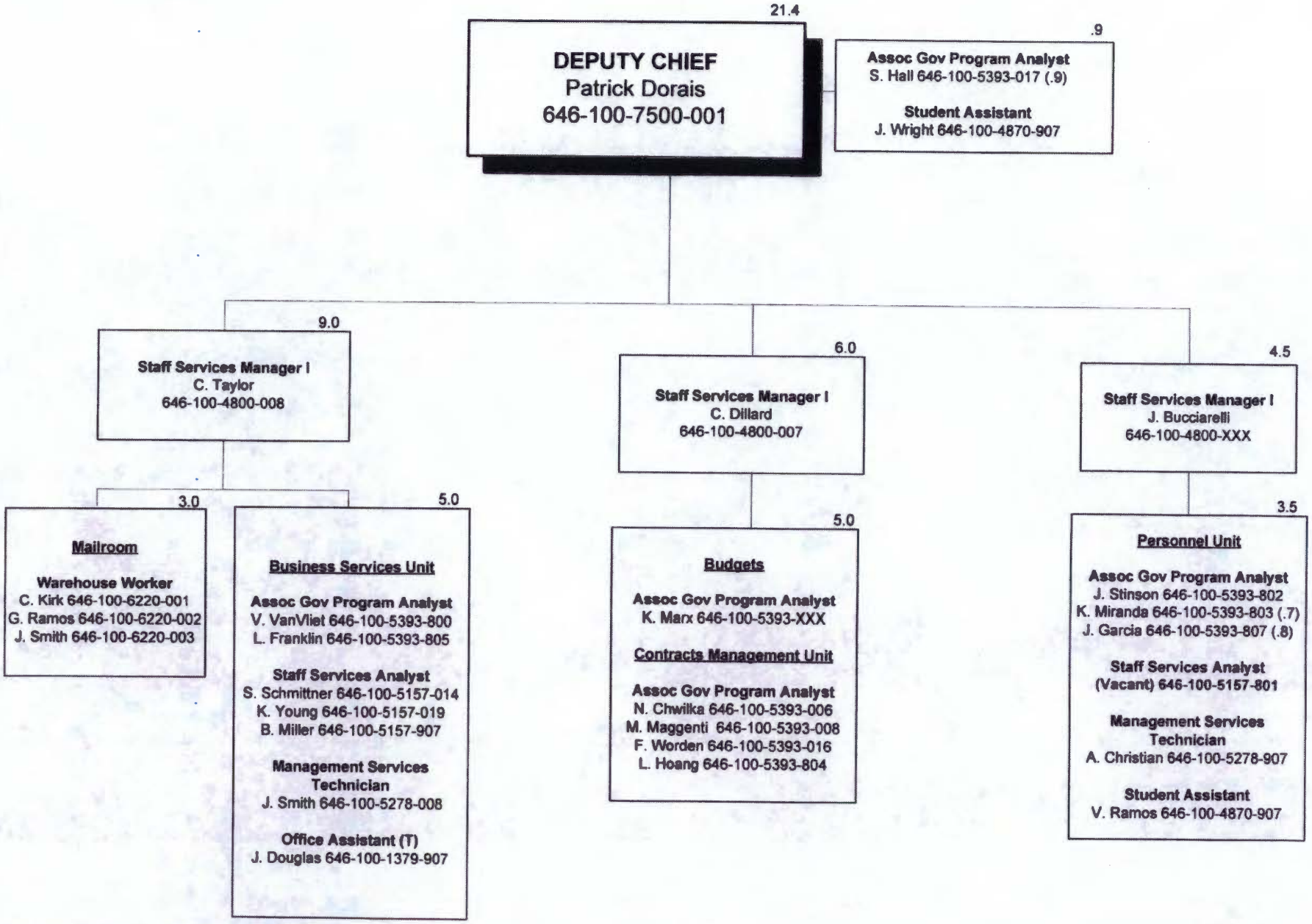
BUREAU OF AUTOMOTIVE REPAIR
SMOG CHECK OPERATIONS,
ENGINEERING & RESEARCH DIVISION

July 2012



BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

July 2012



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

July 2012

DEPUTY CHIEF
Patrick Dorais
646-100-7500-001

Program Manager II
T. Corcoran 646-200-6843-001
62.9

Program Support Division
Staff Services Manager I
T. Wright 646-200-4800-001
40.9

Program Analysis Unit — 3.0

Assoc Gov Program Analyst
N. Sullivan 646-200-5393-012

Staff Services Analyst
J. VanSant 646-200-5157-006
R. VanAllen 646-200-5157-009
M. Nguyen 646-300-5157-907

Student Assistant
S. Zenovieff 646-200-4870-907
G. Ramos Jr. 646-200-4870-907
K. Ramirez 646-200-4870-907

Youth Aid
V. Bucciarelli 646-200-9991-907
N. Worden 646-200-9991-907

Invoice Processing & Approval

Management Services Technician
R. Parmenter 646-200-5278-008
S. Lathum 646-200-5278-009

Office Technician (T)
E. Wilson 646-200-1139-011

Application Processing Unit — 27.4

Supervising Program Tech III
T. Linggi 646-200-9926-003

Application Processing/ Deficiency & Re-Evaluation

Program Technician III
R. Basped 646-200-9929-003
V. Walker 646-200-9929-005

Program Technician II
A. Giamugnani 646-200-9928-017
M. Low 646-200-9928-018
T. Odabashian 646-200-9928-019
M. Dawicki 646-200-9928-021
C. Beaslin 646-200-9928-028
C. Hudson 646-200-9928-031
A. Phan 646-200-9928-032
T. T. Le 646-200-9928-034
(Vacant) 646-300-9928-607
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(Vacant) 646-300-9928-616
(Vacant) 646-300-9928-617
(Vacant) 646-300-9928-618 (.4)

CAP File Management & Retrieval

Office Assistant (T)
B. Briones 646-200-1379-011

Office Assistant (G)
J. Robarts 646-200-1441-007

CAP Phone Information Center & Support Staff — 9.5

Program Technician II
M. Perez 646-200-9928-003 *
F. Gomez 646-200-9928-008 *
W. Leicht 646-200-9928-011
K. Kauffman 646-200-9928-015
N. Kelly 646-200-9928-035 *

Program Technician
A. Nolan 646-200-9927-017

Mail Process & CAP Support Services

Office Technician (T)
J. Nord 646-200-1139-012 (.5)
M. Munoz 646-200-1139-013 (.5)
R. Manglicmot 646-200-1139-015
C. Seawell 646-200-1139-016 (.5)
W. Underwood 646-300-1139-907
D. Saechao 646-300-1139-907
S. Ramachandran 646-300-1139-907
J. Streepy 646-300-1139-907
T.P. Le 646-300-1139-907

Program Technician II
T. Corsbie 646-200-9928-020

Technical Services Unit — 13.0

Program Representative III (Sup)
R. Powers 646-200-6824-003

Repair Assistance & Quality Control

Program Representative II
N. Strever 646-200-6823-001

Program Representative I
H. Sam 646-200-6840-001
P. Dietler 646-200-6840-003
R. Powers 646-200-6840-006
D. Juarez 646-200-6840-010
F. Hemati 646-200-6840-019
D. Moreau 646-200-6840-038
E. Oback 646-200-6840-039
T. Smith 646-200-6840-041
J. Santos 646-200-6840-044

Fax Room & Staff Support

Office Technician (T)
D. Partner 646-200-1139-002
L. Eccel 646-300-1139-907
M. Wood 646-300-1139-907

Office Technician (G)
C. Beatty 646-200-1138-004

Technical Services Unit — 8.0

Program Representative III (Sup)
M. Fernandez 646-200-6824-002

Vehicle Retirement & Quality Control

Program Representative II
M. Horndus 646-200-6823-002

Program Representative I
L. Kyle 646-200-6840-018
T. Matoba 646-200-6840-021
R. Meyer 646-200-6840-036
H. Pittman 646-200-6840-040

Assoc Gov Program Analyst
E. Cepin 646-200-5393-009

Management Services Technician
D. Kosanovic 646-200-5278-017

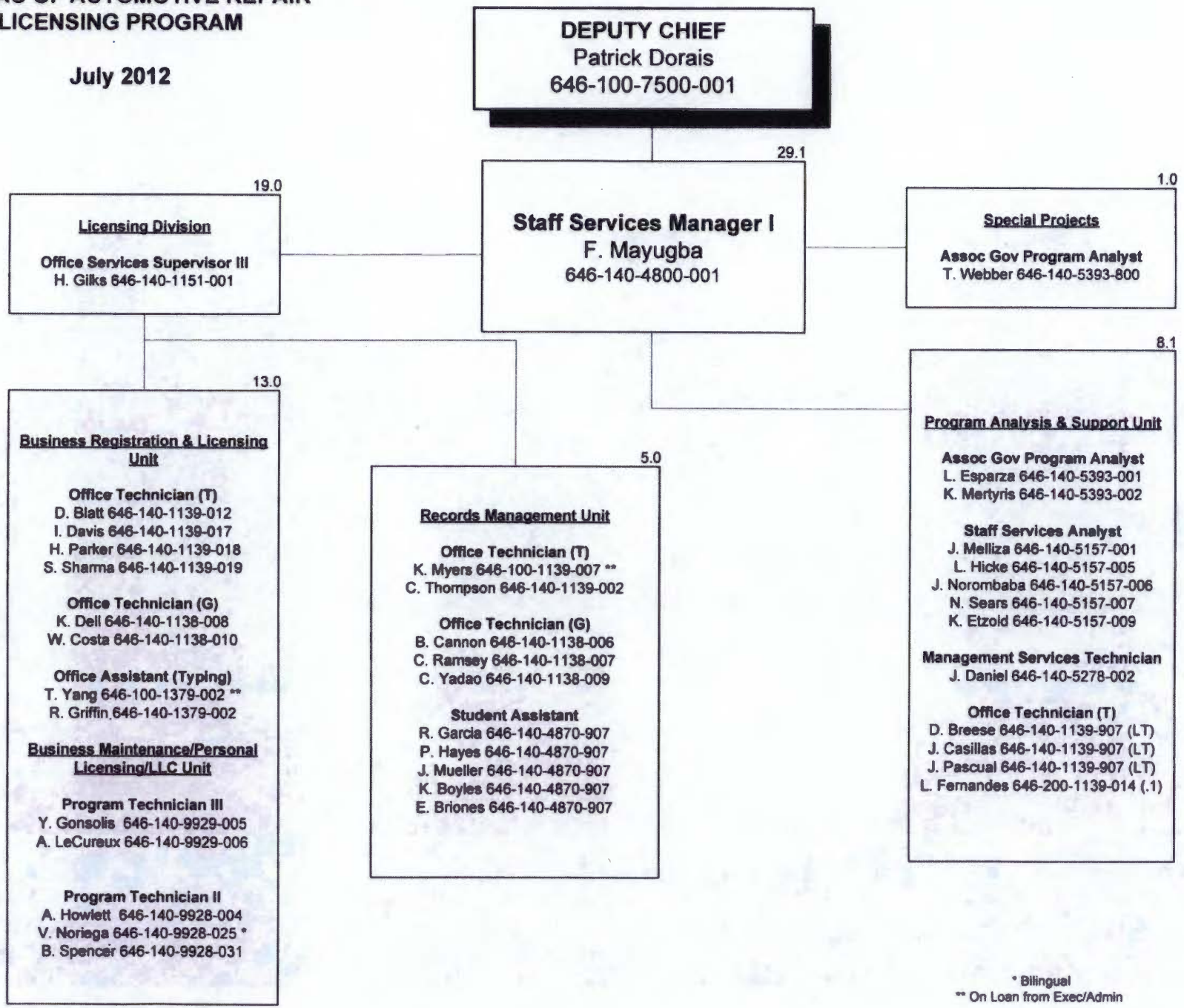
* Bilingual

BCP/LT FY 2012/2013 Positions

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
LICENSING PROGRAM

July 2012



* Bilingual
** On Loan from Exec/Admin

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

July 2012

393.95
FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN

68.6
Vehicle Documentation Program
Program Manager II
W. Ramos

134.4
Northern California Field Operations & Enforcement Branch
Program Manager II
D. Povey

153.95
Southern California Field Operations & Enforcement Branch
Program Manager II
R. Baca

36.0
Enforcement Planning & Oversight Branch
Program Manager II
M. Lafferty

72.4
Region 1 Central Valley
Program Manager I
P. Neeley

59.0
Region 2 San Francisco Bay Area
Program Manager I
B. Machado

71.95
Region 4 Los Angeles
Program Manager I
G. Urena

81.0
Region 5 Orange/Inland Empire /San Diego
Program Manager I
M. Gibson

35.0
Complaint Intake & Case Management
Program Manager I
W. Thomas

36.0
Sacramento
Program Rep III (Sup)
J. Ramos
C, Holmes
R. Bigelow

14.0
South San Francisco
Program Rep. III (Sup)
F. Reyes III

21.25
Valencia
Program Rep. III (Sup)
M. Casillas
J. Echevarria

25.0
San Diego
Program Rep. III (Sup)
W. Zelenka

10.0
Gold Shield Enforcement/ Complaint Review
Program Rep. III (Sup)
G. Dinsdale

24.0
Fresno
Program Rep. III (Sup)
G. Sanchez
W. Malone

19.0
San Jose
Program Rep. III (Sup)
D. Johnson
L. Tanimasa

24.0
Culver City
Program Rep. III (Sup)
F. Sanchez
D. Cunningham

31.0
Riverside
Program Rep. III (Sup)
A. Loyola
L. Ponce

11.0
Case Management/ Applications/ Citations
Program Rep. III (Sup)
G. Pearson

12.4
Bakersfield
Program Rep. III (Sup)
J. Blanton

25.0
Hercules
Program Rep. III (Sup)
J. Murphy

22.7
South El Monte
Program Rep. III (Sup)
R. Martin
R. Steele

22.0
Irvine
Program Rep. III (Sup)
M. Loftus
L. Longoria

6.0
Research & Analysis Units
Staff Services Manager I
J. Brode

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

July 2012

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN
646-100-7500-005

Northern California Field Operations & Enforcement Branch — 134.4
Program Manager II
D. Povey
646-150-6843-001

Program Representative III (Spec) — 2.0
R. McLarty 646-150-7913-001

Program Representative II
R. Gutierrez 646-150-6823-008

Region I Central Valley — 72.4
Program Manager I
P. Neeley
646-150-6842-004

Sacramento — 36.0
Program Representative III (Sup)
J. Ramos 646-152-6824-002 *
C. Holmes 646-152-6824-003
R. Bigelow 646-152-6824-907

Program Representative II
M. Guess 646-152-6823-002
T. Bowden 646-152-6823-003
M. Johnson 646-152-6823-005
M. Eddy 646-152-6823-008
J. Dingman 646-152-6823-009

Program Representative I
D. Mueller 646-152-6840-002
K. Renihan 646-152-6840-003
B. Cole 646-152-6840-004
P. Lessard 646-152-6840-005
D. Brown 646-152-6840-008
T. O'Neill 646-152-6840-009
T. Wilson 646-152-6840-011
T. Toy 646-152-6840-012
C. Woodward 646-152-6840-013
J. Rodriguez 646-152-6840-014
J. Hammer 646-152-6840-016
K. Myers 646-152-6840-017
T. Schaumburg 646-152-6840-018
W. Boese 646-152-6840-020
T. White 646-152-6840-021
(Vacant) 646-152-6840-022
R. Schumann 646-152-6840-024
P McReynolds 646-152-6840-025
M. Sacco 646-152-6840-027
J. Wilcox 646-152-6840-028
G. Michelier 646-152-6840-029
P. Zellmer 646-152-6840-030
B. Hancock 646-152-6840-031
M. Barnett 646-152-6840-032
R. Washington 646-152-6840-033
J. Dickerman 646-152-6840-907
S. Treadway 646-210-6840-031

Office Technician (T)
J. Wright 646-152-1139-004
R. Thomas 646-152-1139-011

Office Assistant (T)
K. Sanchez 646-152-1379-001

Youth Aid
E. Kranhold 646-152-9991-907
C. Blood 646-100-9991-907**

Fresno — 23.0
Program Representative III (Sup)
G. Sanchez 646-154-6824-001
W. Malone 646-154-6824-002

Program Representative II
W. Nicks 646-154-6823-002
J. Esmay 646-154-6823-003
W. Thygesen 646-154-6823-005
A. Lee 646-154-6823-006

Program Representative I
J. Gonzalez 646-154-6840-001 *
J. Tikijian 646-154-6840-003
J. Moore 646-154-6840-006
J. Lewis 646-154-6840-008
D. Bryant 646-154-6840-009
B. Young 646-154-6840-010
J. Lee 646-154-6840-011
M. Morse 646-154-6840-012
J. Enos 646-154-6840-014
W. Bennett 646-154-6840-015
G. Gean 646-154-6840-017
R. Grasmick 646-154-6840-018
J. Mondeau 646-154-6840-019 *
E. Nichols 646-154-6840-020
G. Castro 646-154-6840-021 *

Office Technician (T)
R. Martinez 646-154-1139-002 *
M. Correa 646-154-1139-006 *

Bakersfield — 12.4
Program Representative III (Sup)
J. Blanton 646-155-6824-002

Program Representative II
J. Smith 646-155-6823-001
E. Lopez 646-155-6823-002 *
P. Narayan 646-155-6823-006

Program Representative I
K Teraoka 646-155-6840-002
R. Coble 646-155-6840-003
A. Copeland 646-155-6840-005
C. McClenny 646-155-6840-007
J. Salas 646-155-6840-010 *
D. Moyer 646-155-6840-012

Office Technician (T)
S. Speer 646-155-1139-001 *
C. Bradley 646-155-1139-003
A. Palmer 646-155-1139-004 (0.4)

Region 2 San Francisco Bay Area — 59.0
Program Manager I
B. Machado
646-150-6842-003

South San Francisco — 14.0
Program Representative III (Sup)
F. Reyes III 646-162-6824-001

Program Representative II
B. Saugez 646-162-6823-001
W. Sam 646-162-6823-002

Program Representative I
A. Moreno 646-162-6840-003
N. Cano 646-162-6840-004
G. Sato 646-162-6840-005
H. Jennings 646-162-6840-006
C. Cummings 646-162-6840-007
P. Kuffel 646-162-6840-008
M. Rivas 646-162-6840-009
D. Cervantez 646-162-6840-010
J. Ribiero 646-162-6840-012
W. Long 646-162-6840-907

Office Technician (T)
Y. Lindsey 646-162-1139-001
B. Raygoza 646-162-1139-002 *
V. Buell 646-162-4687-907 LT

San Jose — 19.0
Program Representative III (Sup)
D. Johnson 646-153-6824-001
L. Tanimasa 646-153-6824-002

Program Representative II
L West 646-153-6823-001
K. Windsor 646-153-6823-002
F. Fortugaliza 646-153-6823-005

Program Representative I
M. Sexton 646-153-6840-001
A. Escobar 646-153-6840-003
S. Savage 646-153-6840-005
W. Gress 646-153-6840-008
D. Hernandez 646-153-6840-009
K. Smith 646-153-6840-010
J. Sunseri 646-153-6840-011
A. Avdeef 646-153-6840-012
J. Anderson 646-153-6840-019
A. Sanchez 646-153-6840-020
S. Orozco 646-153-6840-021 *

Office Technician (T)
H. Umali 646-153-1139-001
F. Jaculina 646-153-1139-003

Office Assistant (T)
P. Vera 646-153-1379-001

Hercules — 25.0
Program Representative III (Sup)
J. Murphy 646-151-6824-002

Program Representative II
M. Rodriguez 646-151-6823-002
G. Huffer 646-151-6823-004
J. Mora 646-151-6823-007 *
J. Cheung 646-151-6823-008
S. Rhodes 646-151-6823-009

Program Representative I
G. Sneller 646-151-6840-002
M. Loveless 646-151-6840-003
S. Choy 646-151-6840-005
G. Wilson 646-151-6840-006
B. Withnell 646-151-6840-007
P. Rice 646-151-6840-008
F. Chu 646-151-6840-014
R. Ortiz 646-151-6840-015
C. Lev 646-151-6840-017
G. Bernes 646-151-6840-018
R. Peach 646-151-6840-019
D. Breitbach 646-151-6840-020
Z. Ali 646-151-6840-021
R. Perkins 646-151-6840-022
D. Loredo 646-151-6840-023
M. Avitia 646-151-6840-024 *
R. Leggett 646-151-6840-031

Office Technician (T)
L. Witt-Saucer 646-151-1139-002
E. Simmons 646-151-1139-004

* Bilingual
** On loan from Admin.

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

July 2012

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN
646-100-7500-005

153.95
Southern California Field Operations & Enforcement Branch

Program Manager II
R. Baca
646-160-6843-001

3.0
Program Representative II
N. Magana 646-160-6823-002
I Evans 646-160-6823-008

Management Services Technician
R. Acosta 646-160-5278-001 *

71.95
Region 4
Los Angeles

Program Manager I
G. Urena
646-160-6842-002

81.0
Region 5
Orange/Inland Empire/San Diego
Program Manager I
M. Gibson
646-158-6842-001

2.0
Program Representative II
M.Ortega 646-160-6823-011

Staff Services Analyst
L. Lopez 646-161-5157-001

Valencia (21.25)

Program Representative III (Sup)
M. Casillas 646-159-6824-003
J. Echevarria 646-159-6824-004

Program Representative II
S. Horvath 646-159-6823-008 (.25)

Program Representative I
W. Heimback 646-159-6840-001
M. Darcy 646-159-6840-003
D. Palmer 646-159-6840-004
R. Uribe 646-159-6840-005
J. Ayres 646-159-6840-006
R. Chavez 646-159-6840-010 *
M. Schumann 646-159-6840-013
H. Torres 646-159-6840-015 *
F. Goodgame 646-159-6840-016
C. Jensen 646-159-6840-017
C. Loessberg Jr. 646-159-6840-020
S. Blakely 646-159-6840-021
L. McConnell 646-159-6840-028
J. Heaton 646-159-6840-032
S. Happoldt 646-159-6840-033
N. Stewart 646-159-6840-034

Office Technician (T)
L. Finton 646-159-1139-002
E. Rosario 646-159-1139-004
E. Romero 646-159-1139-005

Culver City (24.0)

Program Representative III (Sup)
F. Sanchez 646-156-6824-002 *
D. Cunningham 646-156-6824-003

Program Representative II
P. Beasom 646-156-6823-001
F. Moore 646-156-6823-002
L. Marin 646-156-6823-003 *
L. Barbee 646-156-6823-005

Program Representative I
D. Schwartz 646-156-6840-001
C. Schooss 646-156-6840-002
A. Ramos 646-156-6840-003 *
R. Jacoby 646-156-6840-006
G. Leano 646-156-6840-007
J. Basurto 646-156-6840-008 *
O. Minasyan 646-156-6840-009
R. Myers 646-156-6840-010
M. Cabeza Jr. 646-156-6840-012
A. Wolfe 646-156-6840-013
R. Galvan 646-156-6840-014 *
R. Robbins 646-156-6840-015
P. Lutfi 646-156-6840-016
K. Sanderson 646-156-6840-018
O. Medina 646-156-6840-019

Office Technician (T)
T. Hart 646-156-1139-001
(Vacant) 646-156-1139-004
M. Hall 646-156-1139-005
V. Jones 646-156-1139-907

South El Monte (22.7)

Program Representative III (Sup)
R. Martin 646-160-6824-001
R. Steele 646-160-6824-003

Program Representative II
A. Steele 646-160-6823-007**
A. Santana 646-160-6823-009 *
B. Yung 646-160-6823-010
H. Shamirian 646-160-6823-012

Program Representative I
B. Vu 646-160-6840-001
G. Romo 646-160-6840-002
C. Pagano 646-160-6840-005
S. Williams 646-160-6840-006
M. Salas 646-160-6840-007
C. Radford 646-160-6840-010
L. Aguilar 646-160-6840-012 *
D. Pace 646-160-6840-013
D. Hegybeli 646-160-6840-015
F. Baldwin 646-160-6840-016
P. Grimmie 646-160-6840-019
R. Crews 646-160-6840-021 (.70)
W. Kiplinger 646-210-6840-026
W. Sear 646-210-6840-907
O. James 646-210-6840-029 *

Office Technician (T)
V. Martinez 646-160-1139-002 *
M. Salazar 646-160-1139-003
E. Najar 646-160-1139-005 *

Irvine (22.0)

Program Representative III (Sup)
M. Loftus 646-157-6824-001
L. Longoria 646-157-6824-002

Program Representative II
P. Smith 646-157-6823-004
M. Wilson 646-157-6823-006

Program Representative I
M. Musid 646-157-6840-002
L. Filippelli 646-157-6840-003
C. Falls 646-157-6840-004
E. McBroom 646-157-6840-005
J. Carlson 646-157-6840-006
S. Miller 646-157-6840-007
R. Lukens 646-157-6840-009
P. Baker 646-157-6840-011
R. Locke 646-157-6840-013
A. Hahn 646-157-6840-014
B. Galarza 646-157-6840-017
C. Bell 646-157-6840-018
J. Venegas 646-157-6840-019
D. Drucker 646-157-6840-020
S. Arreola 646-210-6840-027 *

Office Technician (T)
B. Brazeal 646-157-1139-001
(Vacant) 646-157-1139-004 *
Z. Tilva 646-157-1139-005

San Diego (25.0)

Program Representative III (Sup)
W. Zelenka 646-161-6824-001

Program Representative II
K. Day 646-161-6823-001
E. Kendall 646-161-6823-002
G. Lane 646-161-6823-005
D. Winkowski 646-161-6823-006
W. Neu 646-161-6823-907

Program Representative I
P. Kaliszewski 646-161-6840-001
J. Marquez 646-161-6840-002 *
R. Dearie 646-161-6840-003 *
F. Caraballo 646-161-6840-006 *
M. Spivey 646-161-6840-009
J. Reyes 646-161-6840-010 *
K. McKee 646-161-6840-011
R. Cassel 646-161-6840-013
J. Pendleton 646-161-6840-014
W. Wright 646-161-6840-015
J. Szalach 646-161-6840-016
A. Blumer 646-161-6840-017
J. Klema 646-161-6840-018
K. Mott 646-161-6840-019
R. Haynes 646-161-6840-020
S. Lorenzen 646-210-6840-023
J. Neal 646-210-6840-024

Office Technician (T)
C. O'Neill 646-161-1139-004
P. Cobb 646-161-1139-006

Office Assistant (T)
L. Aguirre 646-161-1379-001 *

Riverside (31.0)

Program Representative III (Sup)
L. Ponce 646-158-6824-002
A. Loyola 646-158-6824-003

Program Representative II
R. Gottenbos 646-158-6823-001
M. Bradfield 646-158-6823-002
R. Castleman 646-158-6823-004
M. Groseth 646-158-6823-005
B. Pravica 646-158-6823-007

Program Representative I
R. Hunter 646-158-6840-001
A. Denno 646-158-6840-002
V. Headlee 646-158-6840-003
S. Koch 646-158-6840-004
W. Meyer 646-158-6840-005
R. Wright 646-158-6840-006
R. Snyder 646-158-6840-007
J. Blair 646-158-6840-008
A. Montalvo 646-158-6840-011
A. Nyborg 646-158-6840-012
J. Major 646-158-6840-013
W. Ortiz 646-158-6840-015 *
R. Norman 646-158-6840-016
T. Haggstrom 646-158-6840-017
R. Herbst 646-158-6840-018
B. Maclean 646-158-6840-019
C. Pepes 646-158-6840-021
R. Headlee 646-158-6840-022
J. Bednorz 646-158-6840-023
D. MartinDelCampo 646-158-6840-024
A. Pepes 646-158-6840-025

Office Technician (T)
D. Ross-Christy 646-158-1139-001
R. Perez 646-158-1139-002 *
R. Malone 646-158-1139-003

* Bilingual
** Reports to R. Martin/ G. Urena

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

July 2012

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN

36.0

Enforcement Planning & Oversight

Program Manager II
M. Lafferty
646-150-6843-002

35.0

Complaint Review & Case Management

Program Manager I
W. Thomas
646-150-6842-002

10.0

Program Representative III (Sup)
G. Dinsdale 646-150-6824-002

Gold Shield Enforcement/Complaint Review

Program Representative III (Spec)
A. Coppage 646-150-7913-002

Program Representative II
A. Chima 646-150-6823-010
W. Cooper 646-150-6823-014

Program Representative I
D. Hatchel 646-210-6840-032

Complaint Intake

Office Services Supervisor I
A. Jones 646-150-1141-001

Office Technician (T)
A. Cowan 646-150-1139-027 *
P. Montiel 646-150-1139-028

Office Technician (G)
B. Hernandez 646-150-1138-001

Program Technician I
P. Tormes 646-140-9927-006 **

11.0

Program Representative III (Sup)
G. Pearson 646-150-6824-003

Case Management/Applications/ Citations

Program Representative III (Spec)
S. Nowotenski 646-210-7913-002

Program Representative II
R. Lehman 646-150-6823-001
M. Kyotani 646-150-6823-004
C. Pryor 646-150-6823-006
J. Lopez 646-210-6823-002 *

Retired Annuitant PR II
J. Ainsworth 646-150-6823-907

Assoc Gov Program Analyst
T. Montoya 646-150-5393-002
R. Harris 646-150-5393-802

Staff Services Analyst
P. Contreras 646-150-5157-016

Management Services Technician
Z. Richardson 646-150-5278-001

Office Technician (T)
S. Haynes 646-150-1139-016

7.0

Enforcement Statistics

Assoc. Gov. Program Analyst
B. Curtis 646-150-5393-003

Staff Services Analyst
D. Holmes 646-150-5157-002
M. Richardson 646-150-5157-010
C. Hirst 646-150-5157-011
R. DaVeiga 646-150-5157-014

Office Technician (T)
L. Gibson 646-150-1139-001
S. Rubin 646-150-1139-023

6.0

Staff Services Manager I
J. Brode 646-150-4800-003

Research & Analysis Unit

Assoc. Gov. Program Analyst
S. Shinn 646-150-5393-004
V. Somma 646-150-5393-005
C. Bonner-Love 646-150-5393-800

Staff Services Analyst
J. Humphreys 646-150-5157-007
B. Dodson 646-150-5157-015

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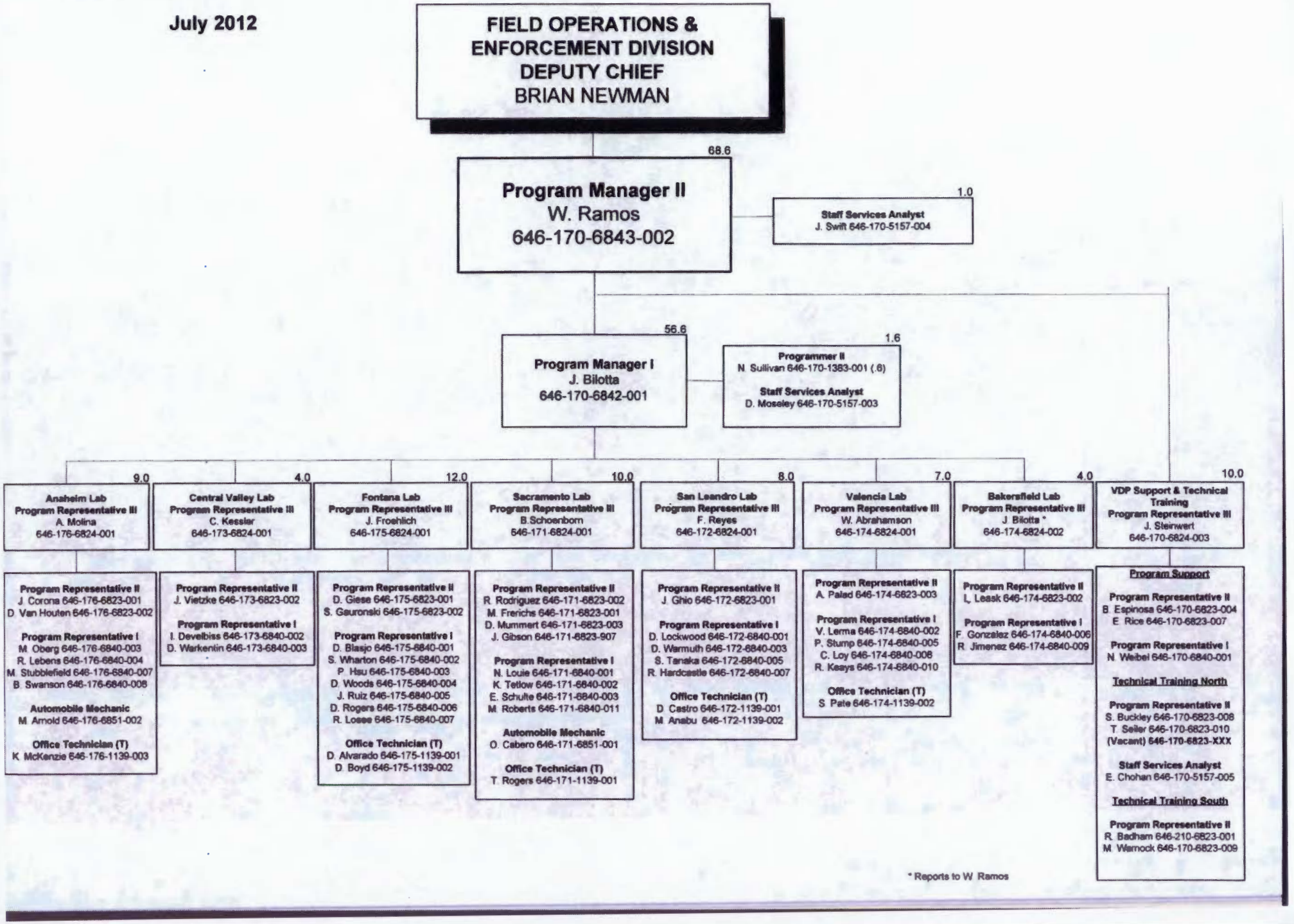
** On loan from Licensing

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
VEHICLE DOCUMENTATION PROGRAM

July 2012

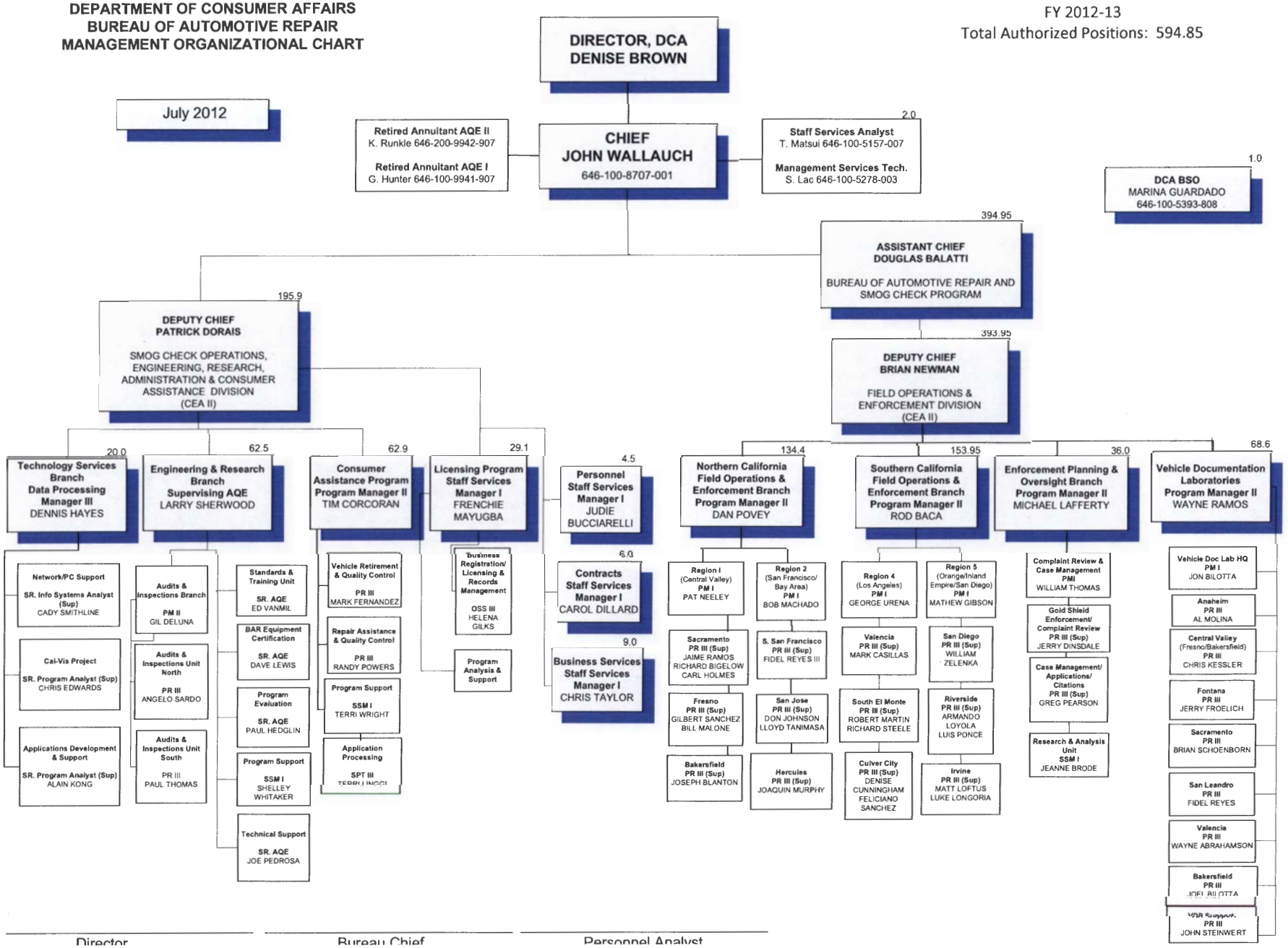


Attachment M

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
MANAGEMENT ORGANIZATIONAL CHART

FY 2012-13
Total Authorized Positions: 594.85

July 2012

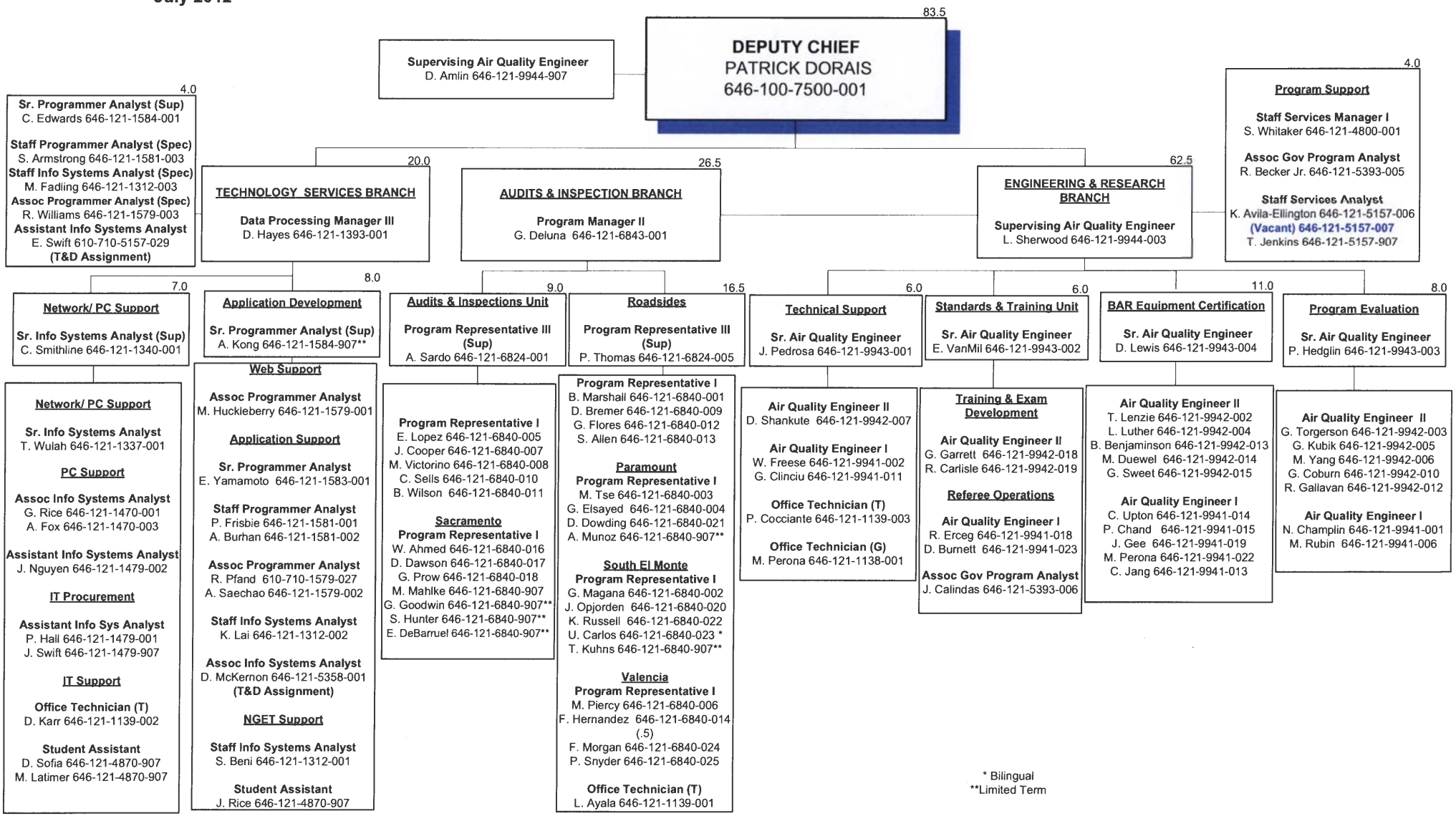


Director | Bureau Chief | Personnel Analyst

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
SMOG CHECK OPERATIONS,
ENGINEERING & RESEARCH DIVISION

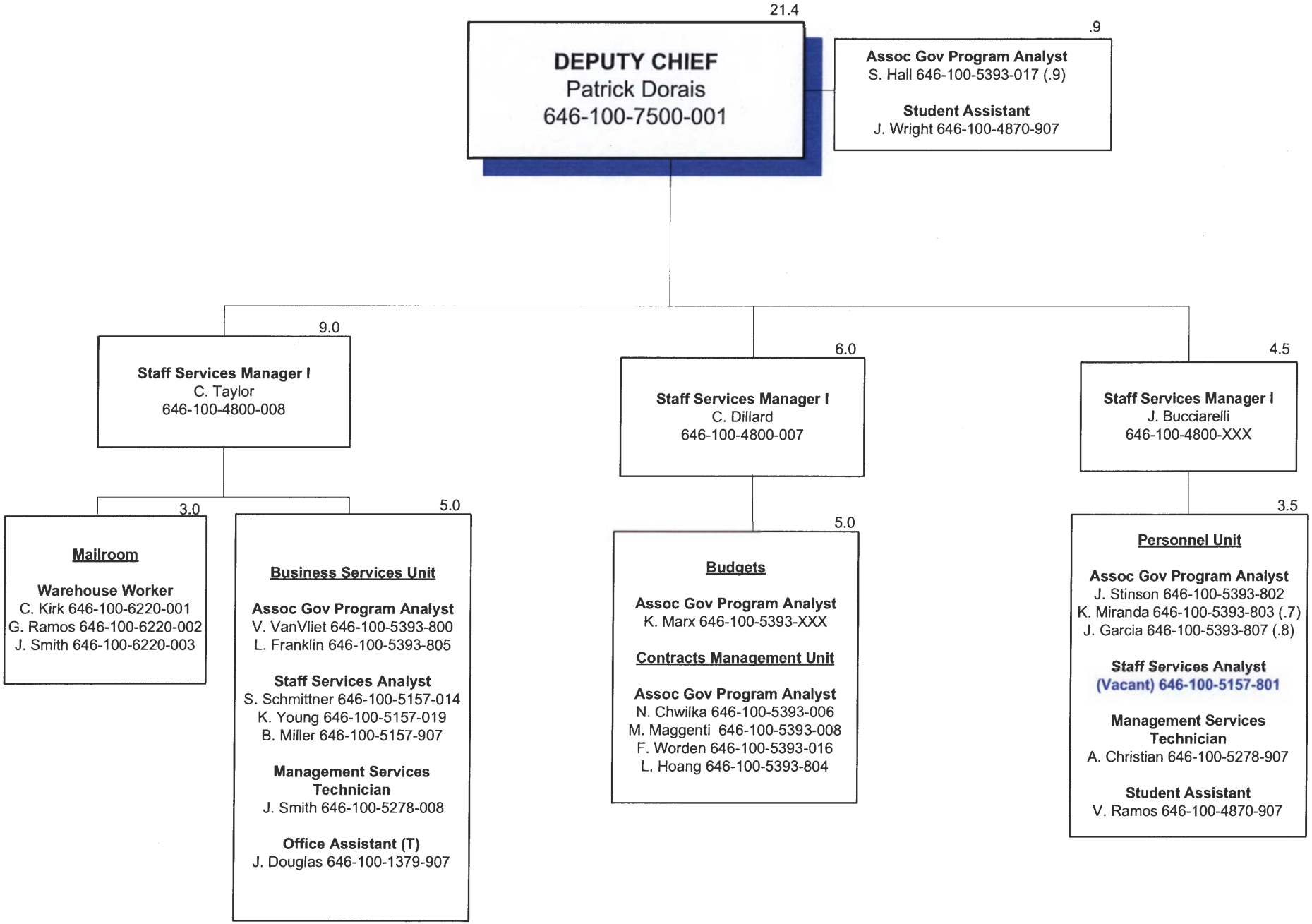
July 2012



Attachment M

BUREAU OF AUTOMOTIVE REPAIR
ADMINISTRATION

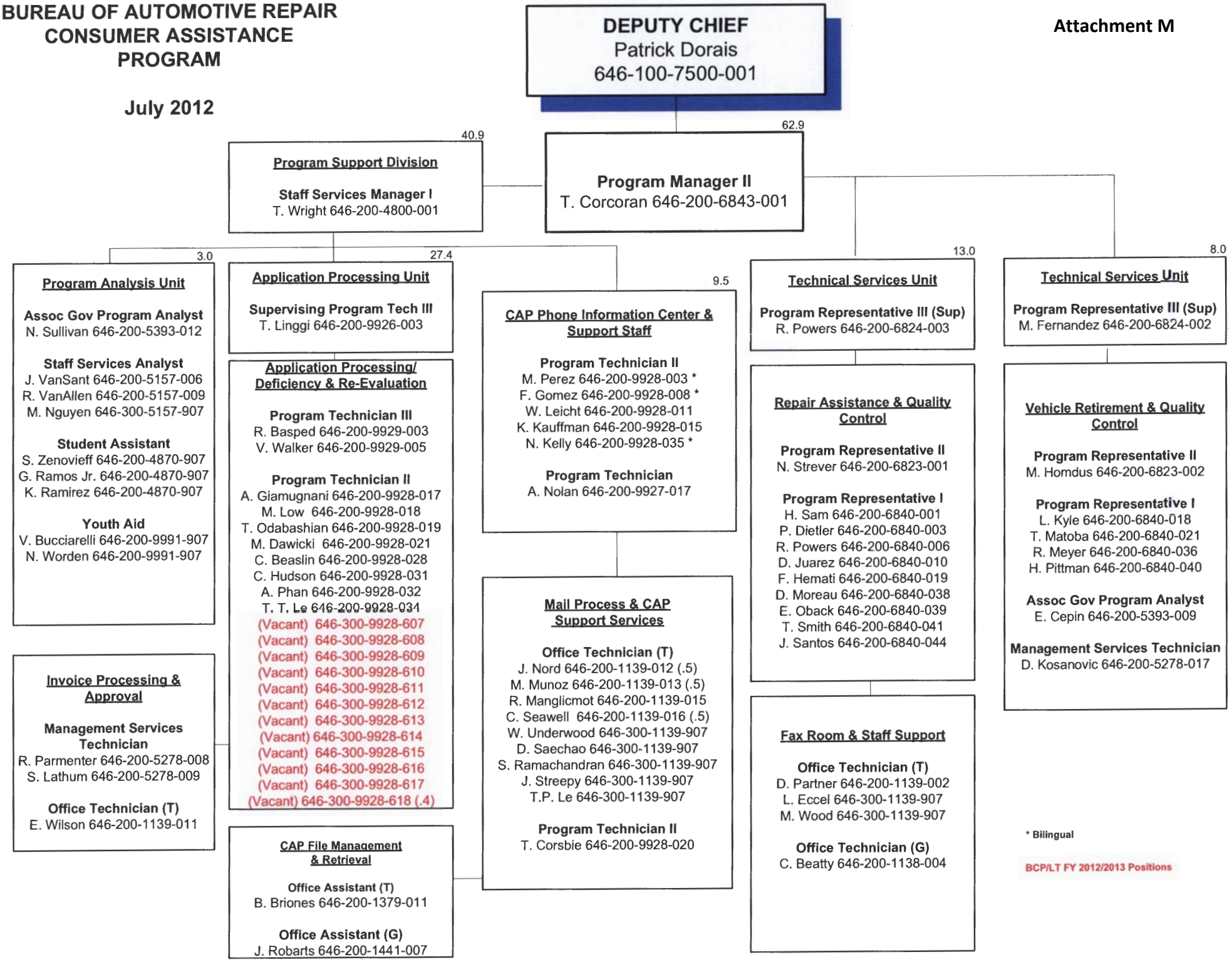
July 2012



BUREAU OF AUTOMOTIVE REPAIR
CONSUMER ASSISTANCE PROGRAM

July 2012

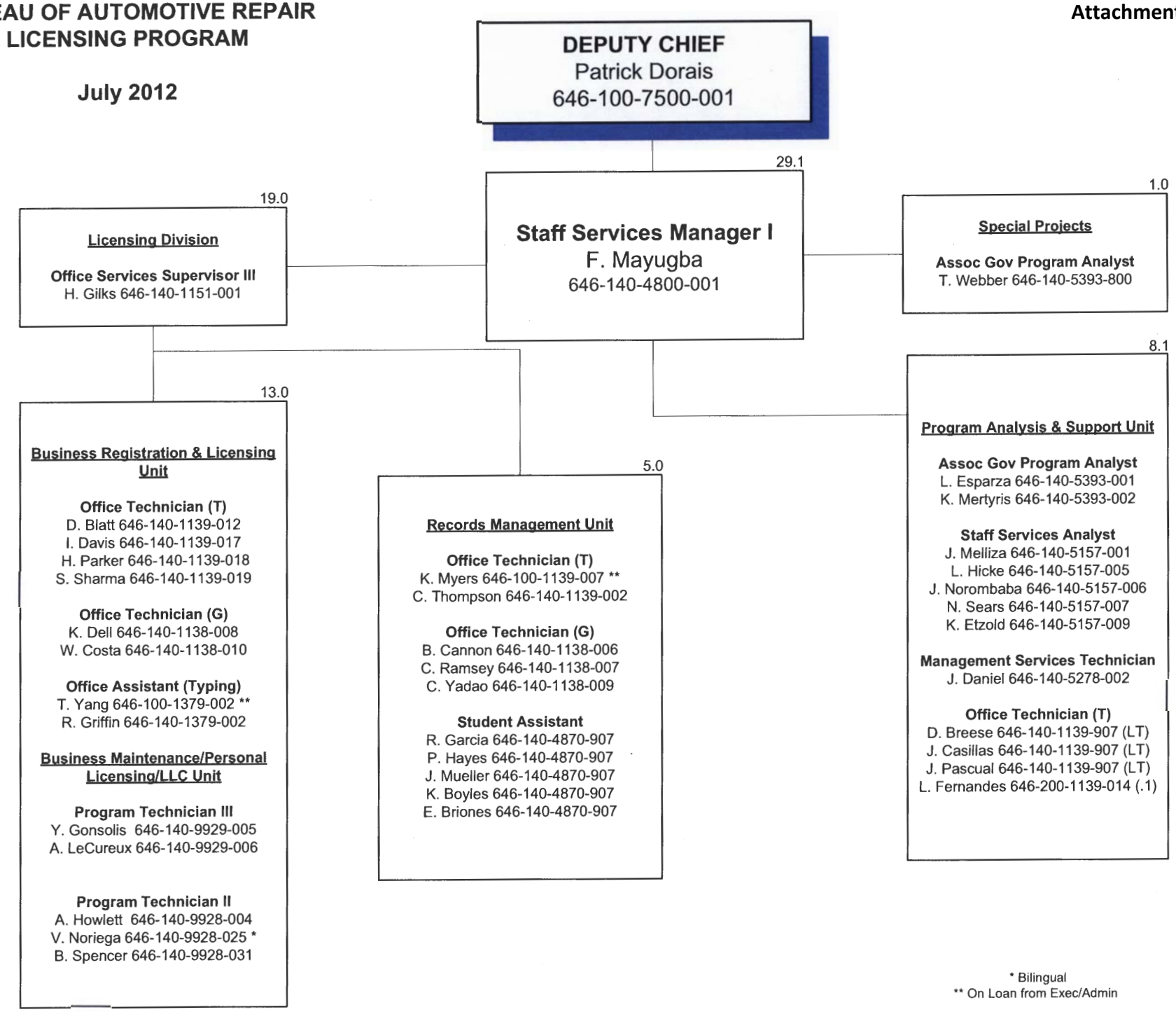
Attachment M



BUREAU OF AUTOMOTIVE REPAIR
LICENSING PROGRAM

July 2012

Attachment M



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** On Loan from Exec/Admin

Attachment M

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

July 2012

393.95

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN

68.6

Vehicle Documentation Program
Program Manager II
W. Ramos

134.4

Northern California Field Operations & Enforcement Branch
Program Manager II
D. Povey

153.95

Southern California Field Operations & Enforcement Branch
Program Manager II
R. Baca

36.0

Enforcement Planning & Oversight Branch
Program Manager II
M. Lafferty

72.4

Region 1
Central Valley
Program Manager I
P. Neeley

59.0

Region 2
San Francisco Bay Area
Program Manager I
B. Machado

71.95

Region 4
Los Angeles
Program Manager I
G. Urena

81.0

Region 5
Orange/Inland Empire /San Diego
Program Manager I
M. Gibson

35.0

Complaint Intake & Case Management
Program Manager I
W. Thomas

10.0

Gold Shield Enforcement/ Complaint Review
Program Rep. III (Sup)
G. Dinsdale

11.0

Case Management/ Applications/ Citations
Program Rep. III (Sup)
G. Pearson

6.0

Research & Analysis Units
Staff Services Manager I
J. Brode

36.0

Sacramento
Program Rep III (Sup)
J. Ramos
C, Holmes
R. Bigelow

14.0

South San Francisco
Program Rep. III (Sup)
F. Reyes III

21.25

Valencia
Program Rep. III (Sup)
M. Casillas
J. Echevarria

25.0

San Diego
Program Rep. III (Sup)
W. Zelenka

24.0

Fresno
Program Rep. III (Sup)
G. Sanchez
W. Malone

19.0

San Jose
Program Rep. III (Sup)
D. Johnson
L. Tanimasa

24.0

Culver City
Program Rep. III (Sup)
F. Sanchez
D. Cunningham

31.0

Riverside
Program Rep. III (Sup)
A. Loyola
L. Ponce

12.4

Bakersfield
Program Rep. III (Sup)
J. Blanton

25.0

Hercules
Program Rep. III (Sup)
J. Murphy

22.7

South El Monte
Program Rep. III (Sup)
R. Martin
R. Steele

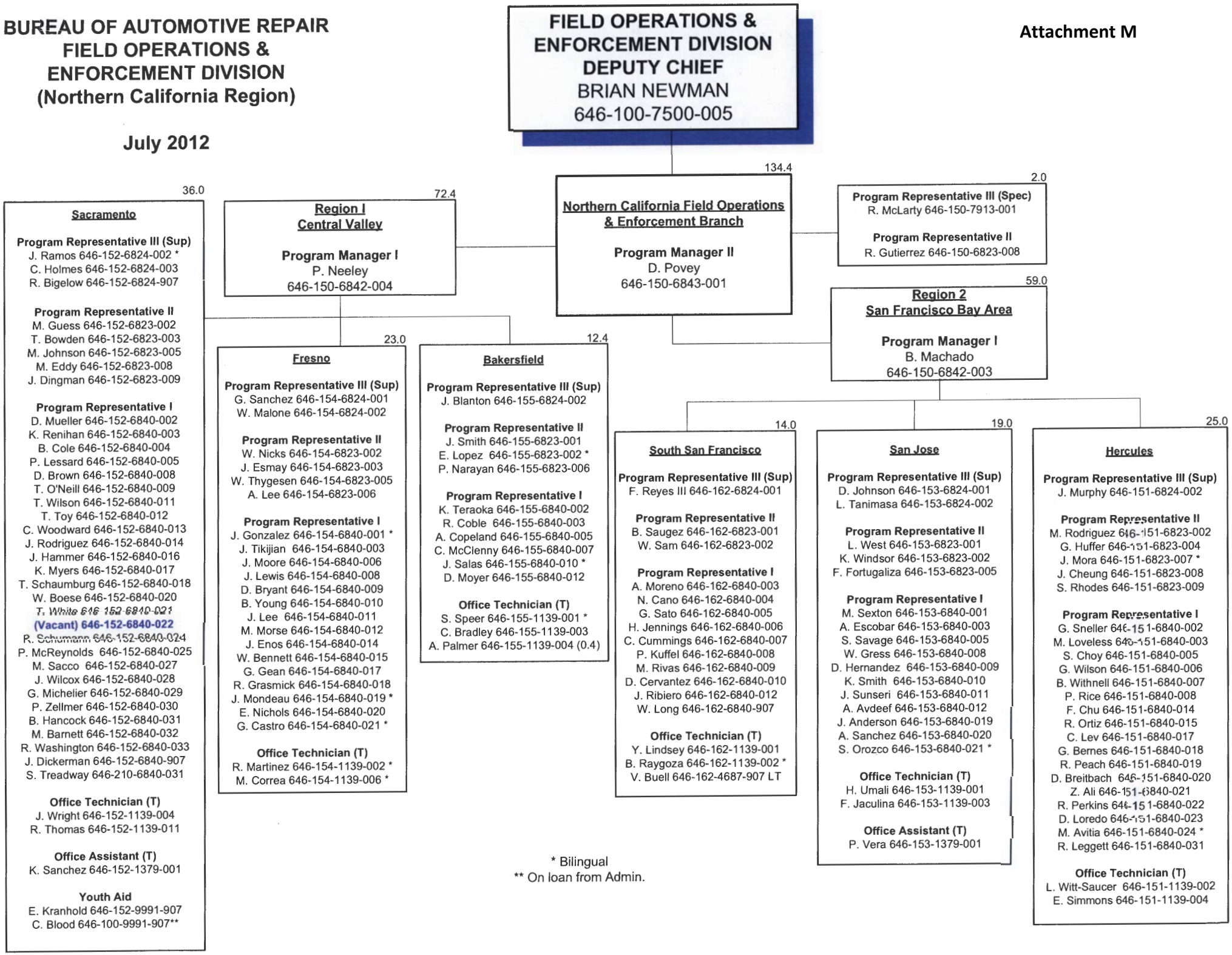
22.0

Irvine
Program Rep. III (Sup)
M. Loftus
L. Longoria

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Northern California Region)

July 2012

Attachment M

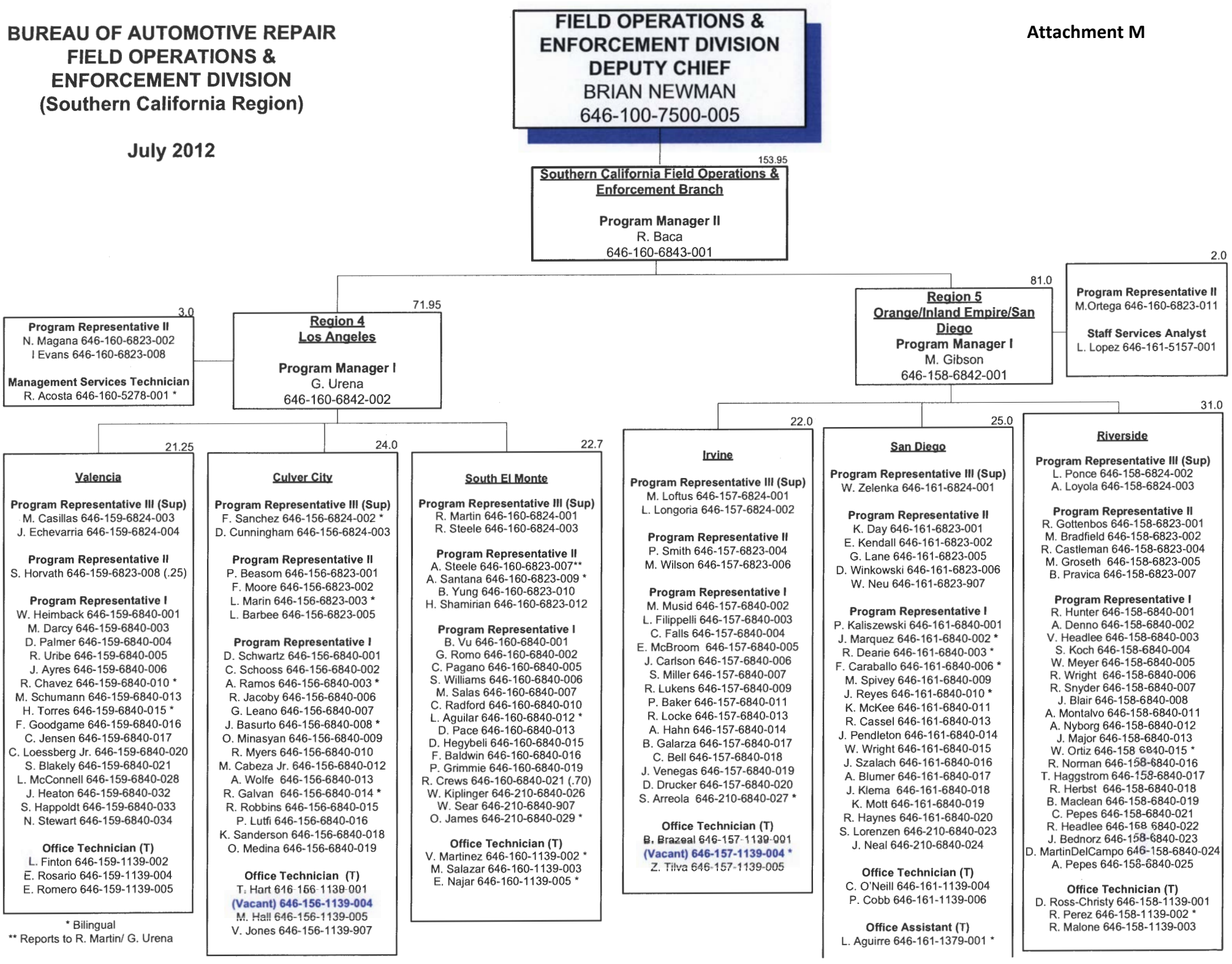


* Bilingual
** On loan from Admin.

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION
(Southern California Region)

July 2012

Attachment M



* Bilingual
** Reports to R. Martin/ G. Urena

BUREAU OF AUTOMOTIVE REPAIR
FIELD OPERATIONS & ENFORCEMENT DIVISION

July 2012

Attachment M

FIELD OPERATIONS & ENFORCEMENT DIVISION DEPUTY CHIEF
BRIAN NEWMAN

36.0

Enforcement Planning & Oversight

Program Manager II
M. Lafferty
646-150-6843-002

35.0

Complaint Review & Case Management

Program Manager I
W. Thomas
646-150-6842-002

10.0

Program Representative III (Sup)
G. Dinsdale 646-150-6824-002

Gold Shield Enforcement/Complaint Review

Program Representative III (Spec)
A. Coppage 646-150-7913-002

Program Representative II
A. Chima 646-150-6823-010
W. Cooper 646-150-6823-014

Program Representative I
D. Hatchel 646-210-6840-032

Complaint Intake

Office Services Supervisor I
A. Jones 646-150-1141-001

Office Technician (T)
A. Cowan 646-150-1139-027 *
P. Montiel 646-150-1139-028

Office Technician (G)
B. Hernandez 646-150-1138-001

Program Technician I
P. Tormes 646-140-9927-006 **

11.0

Program Representative III (Sup)
G. Pearson 646-150-6824-003

Case Management/Applications/ Citations

Program Representative III (Spec)
S. Nowotenski 646-210-7913-002

Program Representative II
R. Lehman 646-150-6823-001
M. Kyotani 646-150-6823-004
C. Pryor 646-150-6823-006
J. Lopez 646-210-6823-002 *

Retired Annuitant PR II
J. Ainsworth 646-150-6823-907

Assoc Gov Program Analyst
T. Montoya 646-150-5393-002
R. Harris 646-150-5393-802

Staff Services Analyst
P. Contreras 646-150-5157-016

Management Services Technician
Z. Richardson 646-150-5278-001

Office Technician (T)
S. Haynes 646-150-1139-016

7.0

Enforcement Statistics

Assoc. Gov. Program Analyst
B. Curtis 646-150-5393-003

Staff Services Analyst
D. Holmes 646-150-5157-002
M. Richardson 646-150-5157-010
C. Hirst 646-150-5157-011
R. DaVeiga 646-150-5157-014

Office Technician (T)
L. Gibson 646-150-1139-001
S. Rubin 646-150-1139-023

6.0

Staff Services Manager I
J. Brode 646-150-4800-003

Research & Analysis Unit

Assoc. Gov. Program Analyst
S. Shinn 646-150-5393-004
V. Somma 646-150-5393-005
C. Bonner-Love 646-150-5393-800

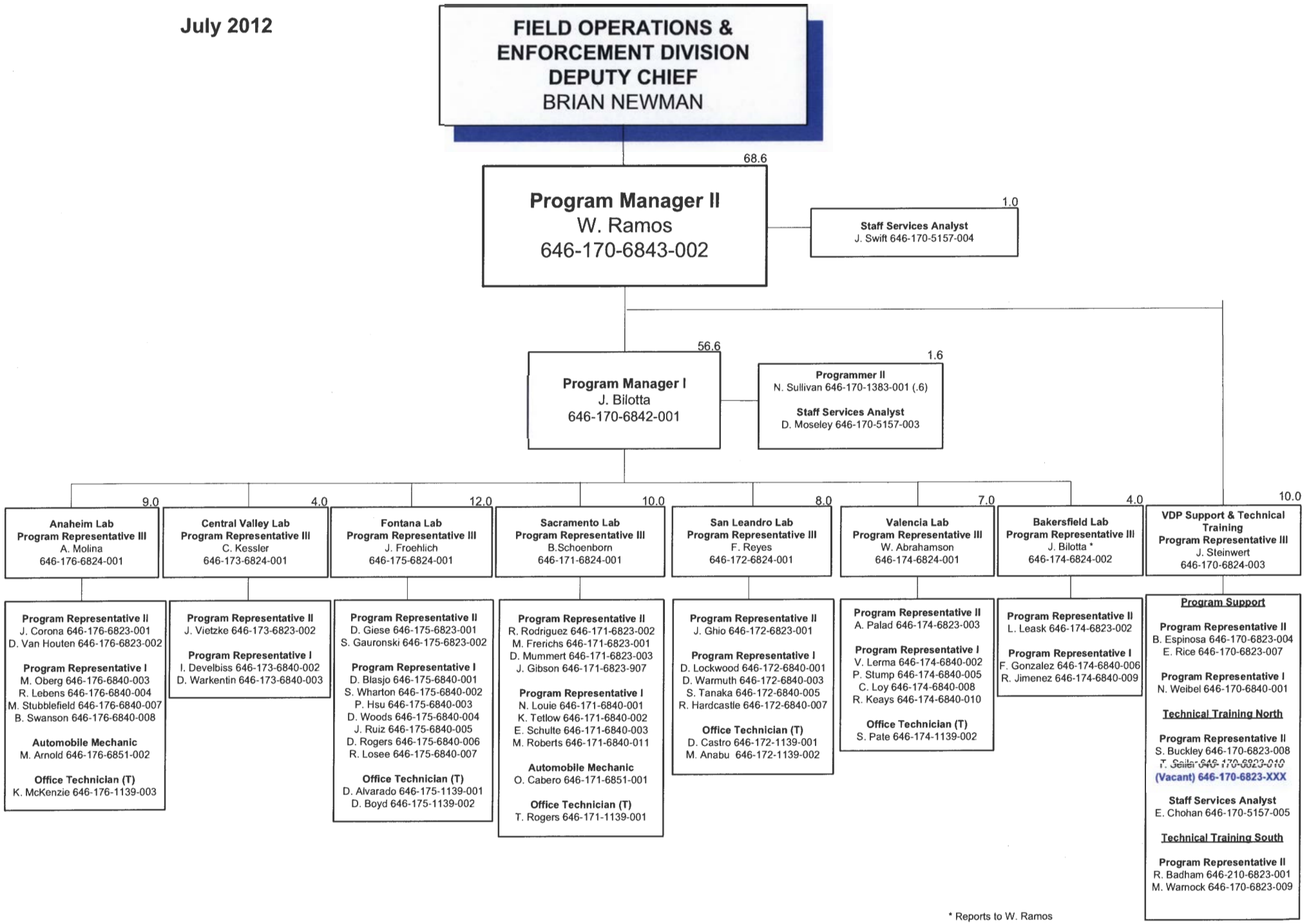
Staff Services Analyst
J. Humphreys 646-150-5157-007
B. Dodson 646-150-5157-015

* Bilingual
** On loan from Licensing

BUREAU OF AUTOMOTIVE REPAIR
VEHICLE DOCUMENTATION PROGRAM

Attachment M

July 2012

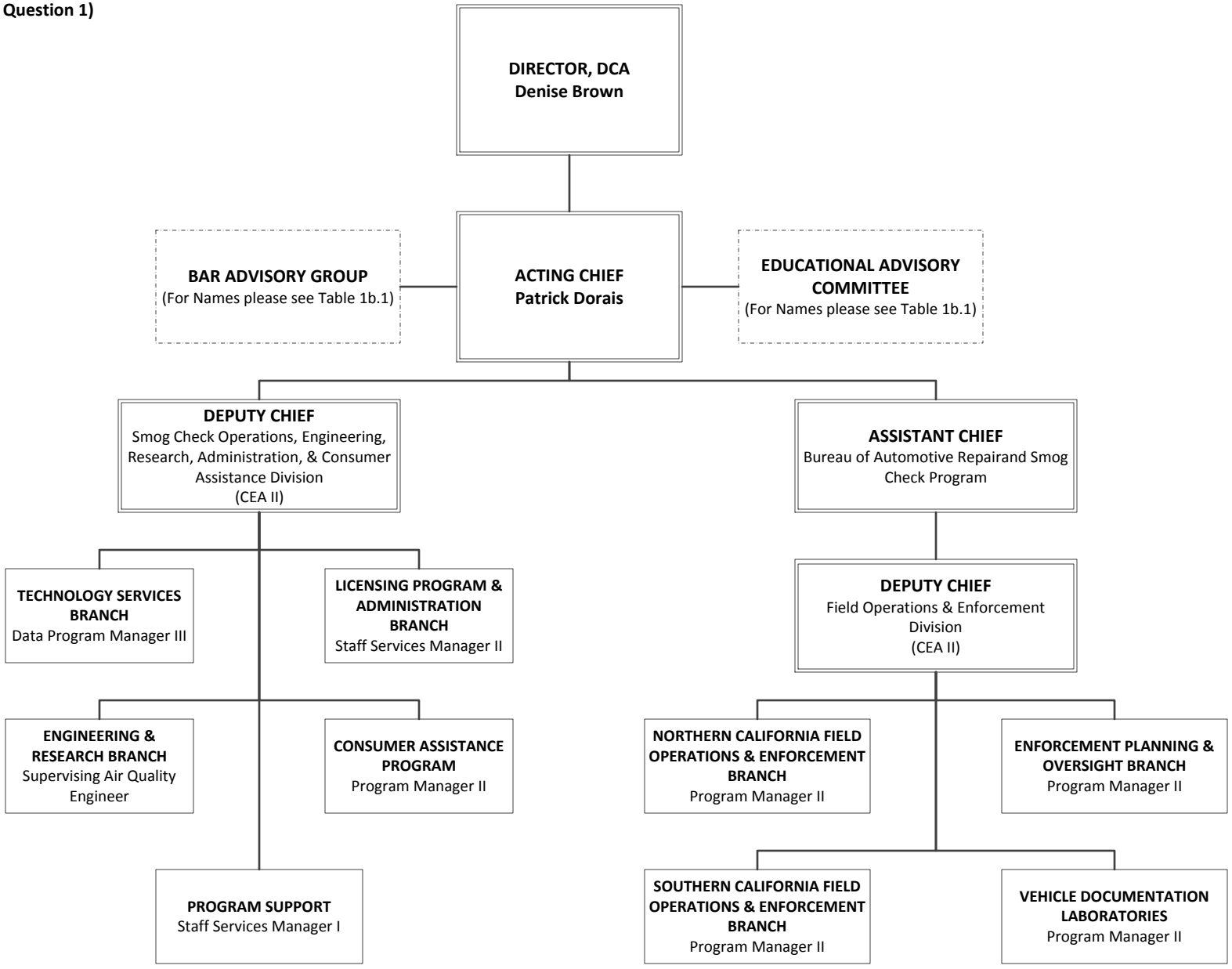


Attachment N

Bureau of Automotive Repair
Committee Organizational Chart

DEPARTMENT OF CONSUMER AFFAIRS
BUREAU OF AUTOMOTIVE REPAIR
Committee Organizational Chart
(Section 1, Question 1)

Attachment N



Attachment O

Bureau of Automotive Repair
Policy and Procedures

Policies and Procedures Manuals
are available in some copies of this report.

Additional copies are available upon request.